PROCEDURES

FOR

INVENTORY AND INSPECTION

OF

TRAFFIC CONTROL DEVICE

STRUCTURES

VIRGINIA DEPARTMENT OF TRANSPORTATION
STRUCTURE AND BRIDGE DIVISION

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PREFACE

Purpose of the Program

The purpose of the program is to inventory and inspect traffic control device structures to provide the Department with the information necessary to determine their physical and functional condition. This information will be used to develop priorities for their maintenance and/or replacement.

Purpose of this Manual

The purpose of this manual is to provide those individuals performing the inventory and inspection of traffic control device structures with the information necessary to complete their duties both safely and thoroughly. This manual is supplemented by the requirements of the current Bridge Inspector's Reference Manual (BIRM), published by the Federal Highway Administration (FHWA) (Report No. FHWA NHI 03-001).

Responsibilities and Duties of the Inspector

The responsibilities and duties of the inspection personnel shall conform to the current Bridge Inspectors Reference Manual.

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CHAPTER 1

INSPECTION PROCEDURES AND PLANNING

1.1 Introduction

The purpose of this chapter is to provide comprehensive procedures, techniques and documentation all personnel will follow while conducting acceptance and regular inspections for a wide variety of in-service highway traffic control device structures.

1.2 Personnel

An inspection team shall consist of a minimum of two people. One shall be a team leader. The team leader shall be the individual in charge of the bridge inspection team and shall meet the qualifications as outlined in the 'Code of Federal Regulations, 23 Highways – Part 650 – Subpart C – National Bridge Inspection Standards.

One or both of the team members shall be experienced in the use of GPS mapping techniques and be knowledgeable with the Virginia Work Area Protection Manual (VWAPM).

All inspection personnel shall have successfully completed a "Fall Protection" class that fulfills the requirements of OSHA 1926.503.

General Safety

- Safety of the inspectors and safety of the motoring public is paramount.
- All overhead activity shall be limited to the areas over lanes that are closed to traffic.
- When in an inspection bucket, the inspector shall have a safety line attached to the boom arm.
- Hardhats and reflectorized traffic vests must be worn while in the work zone.
- The inspectors shall wear approved safety shoes.
- Traffic control procedures shall be followed and cones and/or signs shall be used.
- Vehicles shall be parked as far off of the traveled lane as possible.
- The inspector shall not handle damaged, worn or deteriorated electrical wiring.

Climbing Safety

When an inspector is climbing a structure, the following rules should be followed:

- Climbing will not be allowed on end frames.
- Climbing shall be restricted to only those areas where other access is not available.
- When climbing is necessary, the inspector should only attach to the main load carrying members i.e. chords and one lanyard shall be connected at all times.
- When climbing is necessary, only one person shall be on the structure at a time.
- Prior to and after each use, all safety equipment used for climbing shall be inspected for defects that would alter their strength. Defective units shall not be used.
- Take as few items as possible when climbing, and secure those items so they cannot fall.
- Inspection must be delayed if the inspector is tired or emotionally distressed.
- Boots, ladders, bucket lifts, and scaffolding should be kept free of oil and grease.
- Lifting equipment, whether ladders, bucket lifts, or scaffolding, should be properly secured to the ground with brakes, blocks, outriggers, etc. prior to climbing.
- Whenever possible, difficult-to-reach areas should be inspected with a bucket lift rather than by climbing.

- All inspectors shall be properly trained in the inspection process, climbing techniques, and the use of all equipment.
- In general, the inspector should have three positive points of contact when moving through the structure (both hands and one foot or both feet and one hand in contact with the members).

1.3 Maintenance of Traffic (MOT)

An MOT plan must be developed for each site where a traffic control device structure is to be inspected that requires lane or shoulder closure. Prior to developing any MOT plans, all known information should be gathered pertaining to lane closure restrictions for the District and/or Residency in which the inspection sites are located. If a nonstandard plan is developed, prior to beginning work it must be approved by the District Traffic Engineer.

Signs should be grouped together in a realistic plan based on how much work an inspection team can accomplish in a workday. Consideration should be given to grouping inspection sites such that the number of MOT setups for a day will be minimized. Note that the maximum distance that an MOT setup can be extended is two miles (VDOT requirement). Care must be taken in establishing or extending work zones around interchanges and intersections. Drivers may become confused when they encounter unexpected changes such as an alteration to an exit or entrance ramp.

1.4 Field Procedures

Typical Sign Structures

A successful, quality inspection follows proper safety procedures, sound inspection methods and a well-planned sequence of inspection. The type and size of the sign structure, traffic density and requirements for traffic control will affect the sequence of inspection. Prior to beginning the inspection the team leader shall drive through the traffic control setup to ensure that it follows the MOT plan. The team leader should be looking for obvious deviations from the prescribed plan and the impact the MOT plan has on traffic flow.

In general, the following sequence can be used for inspection:

1) Review available data for sign structure including plans if available.
2) Determine if MOT will be necessary. If so, determine proper MOT plan and, if necessary, develop a non-standard plan for MOT.
3) Conduct the inspection (includes assuring proper MOT is followed).
   Check:
   i. Foundation(s)
   ii. Grout
   iii. Anchor rods, nuts and washers, base plate.
   iv. Support frames or poles, and/or attachment to structure.
   See special requirements listed under 'High Mast Lighting and Camera Poles'. Defects such as weld cracks, missing bolts, loose nuts, etc. shall be identified on the structure with a red paint marker to facilitate location during follow-up inspections or repair.
   v. Span-to-support connection
   vi. Space frame members, welds, chord splices, sign clips, hanger connections and L-brackets
   vii. Walkways, railings, safety chains and signs
   viii. Minimum vertical clearance measurements over each lane and over the shoulders.
   ix. Obtain walkway length, span length, and distance below the sign panel.

x. Obtain sign dimensions - including any small signs on the pole supports and measure the distance from the bottom of the small signs to the top of the foundation.

4) While on-site review the notes for accuracy and completeness. If possible, review the photographs to assure that they clearly depict the deficiency.
5) Complete the appropriate inspection form (See Appendix A). Make repair recommendations based on direction/guidance provided in Appendix B.

When any unsafe conditions are found on access walkways and railings, the platforms shall be tagged at each end with a red plastic tag. The tags shall be located in a conspicuous position.

The guidelines in I&I Memorandum S&B-98-66/TE-277 assists the inspectors in evaluating the structures. Refer also to Appendix B for guidelines for determining maintenance needs for the sign structures. Common sign nomenclature is included in Appendix C.

High Mast Lighting Structures and Camera Poles

In general, the sequence listed above can be used for high mast light and camera pole structures. The inspector shall not climb high mast lighting. To facilitate the inspection of high mast lighting a 20x - 50x spotting telescope will be used for checking the pole, slip joints, welds, connections, luminaires, and all other superstructure parts. The high mast light will be observed from a minimum of four different areas, approximately 90^{o} apart. If required, observations will be conducted at additional locations to ensure 100% of the pole is inspected. It will also be acceptable to use a system that provides equal or better inspection of the poles.

Camera poles are typically equipped with access rungs. The inspector will be required to climb the structure to fully inspect the components.

1.5 Frequency of Inspection

The frequency at which a structure is inspected shall be 60 months unless conditions or type of structure warrants a more frequent inspection.

Four-rod anchorage systems of cantilever structures, high mast light poles, butterfly poles and overhead spans where the end supports consist of single poles shall have the anchor rods inspected every two years utilizing ultrasonic testing.

1.6 Non-Destructive Testing (NDT) Requirements

Variable message signs

- At every inspection magnetic particle testing shall be used at the base plate-to-pole welded connections
- Every two years ultrasonic testing shall be used to check all anchor rods on a four-rod anchorage system for potential cracks.
- Liquid penetrate testing shall be used where magnetic particle testing cannot be used and at other suspect locations to aid in the visual detection of a surface crack.

Cantilevers, high mast light poles, butterfly poles and overhead spans where the end supports consist of single poles

- Every two years ultrasonic testing shall be used to check all anchor rods on a four-rod anchorage system for potential cracks.
- Other forms of NDT testing may be used at other suspect locations to aid in the visual detection of a surface crack.

Other structure types

At the discretion of the team leader, NDT may be used on suspect welds.

- Sounding of the anchor rods with a hammer can be used to determine the need for further NDT on all anchor rod systems that contain more than four rods. A dull or hollow sound indicates the need for ultrasonic testing to check for potential cracks.
- Ultrasonic testing, a D-meter or similar equipment, can be used to check the remaining thickness of structural members that have visible corrosion or are in a highly corrosive environment such as the lower portion of support poles where water may be retained.
- Some form of NDT should be used at all cracked welds to determine the limits of the crack and at surrounding welds for additional cracking. It is good practice to randomly perform NDT on apparently good welds.

In the event the inspector is unable to perform the required or necessary testing, the inspector should contact the Materials Division and arrange to have the necessary tests performed.

1.7 Emergency Situations

It is important that when there is a medical or structural emergency that the appropriate individuals be contact as quickly as possible. To assist in expediting emergency contacts, each inspection team will fill out and retain an Emergency Contact List (see Appendix D).

The identification of structural problems that require immediate action will be the responsibility of the team leader. The team leader will contact the appropriate designated District personnel. The inspector must analyze a problem situation. If the team leader deems it necessary, the MOT setup may be held in place until additional District/VDOT personnel arrive on site.

When an emergency call is made, the inspector should have as much information as possible for the District Structure and Bridge Engineer or their representative. A Critical Recommendation Form (see Appendix E) identifying the problem and outlining the action(s) taken or to be taken must follow up any emergency call. The inspection report should be prepared as soon as possible and should indicate what actions were or will be taken.

Appendix B contains a list of common deficiencies with repair recommendations. Within this list, some critical and/or dangerous deficiencies are identified along with recommendations for immediate notification to the appropriate District Structure and Bridge Engineer. The inspector may utilize this list, but must also be guided by the assessment of a potentially hazardous situation. The inspector's assessment must consider the danger to the motoring public or pedestrians and the sign's structural integrity. Items such as broken welds at the base plate-to-pole weld of a single pole supported cantilever sign, sheared anchor rods (especially in 4-rod configurations), damaged pole-to-arm connections (welds), and broken welds in the flange connections between space frame sections are all obviously severe problems which would likely result in a call to the District Structure and Bridge Engineer. In addition to the structural problems, other problems may require immediate attention such as sign panels that are ready to fall from the structure or parts of a walkway or light fixture that are hanging down in traffic.

1.8 Night Inspection Operations

Whenever night inspections are required, the inspectors must take steps to insure adequate illumination of the inspection surfaces. Lights can be carried or worn by the inspectors, mounted on the inspection bucket, or ground-mounted. The team leader must determine which method(s) of illumination will provide the best view of the inspection surfaces. Lights must be positioned so that they will not be a distraction to oncoming motorists or pedestrians.

Extreme caution should be used during night operations due to the reduced visibility of the inspection personnel to oncoming traffic. Approved reflective vests and hardhats are always required, but can be especially important at night. Wearing light colored clothing is highly recommended.

1.9 Reports and Data Management

An inspection report that contains the findings of the inspection team will be generated for each structure inspected. Once a report has been generated, it is the responsibility of the team leader to review the report for completeness and accuracy and sign the report. After the team leader's review, the report shall be submitted to the District Structure and Bridge Engineer or their representative for a quality control review and final approval. The report shall be completed as soon as practical after the fieldwork is completed and should be finalized within 45 days of performing the field inspection.

Inspections shall be documented on the most current version of the inspection document. Each inspection report will contain photographs showing a view of the structure in the main direction of travel, of the structure and a view showing the legend of each sign panel. A side view is only required if it is needed to show unusual details.

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CHAPTER 2

TYPES OF STRUCTURES

2.1 Overhead Span Sign Structures

There are four types of overhead span sign structures: the four-chord, tri-chord, two-chord, and single-chord.

Four-Chord Overhead Span Sign Structures

The four-chord overhead span sign structure consists of a three-dimensional space frame simply supported at each end by a two-column support frame.

Each space frame is constructed of two vertical parallel-chord plane trusses. Each of the trusses consists of a top and bottom chord connected by vertical posts and diagonal members. The most common four-chord structure is a Pratt Truss. Photo 1 shows a rear view of a four-chord overhead span sign structure.

Photo 1 - Rear View of a Four Chord Overhead Span Structure

To form the space frame, the two trusses are set parallel to each other and joined together by horizontal transverse members and horizontal diagonal members. These members are welded or bolted in place between the two top chords and the two bottom chords, thus forming the rectangular cross-section of the space frame. Interior diagonal members are also framed between the two vertical trusses. Each interior diagonal connects a top panel point of one truss with the corresponding bottom panel point of the other truss. The interior diagonals alternate in direction with each panel. Photo 2 shows a close-up view of a panel point.

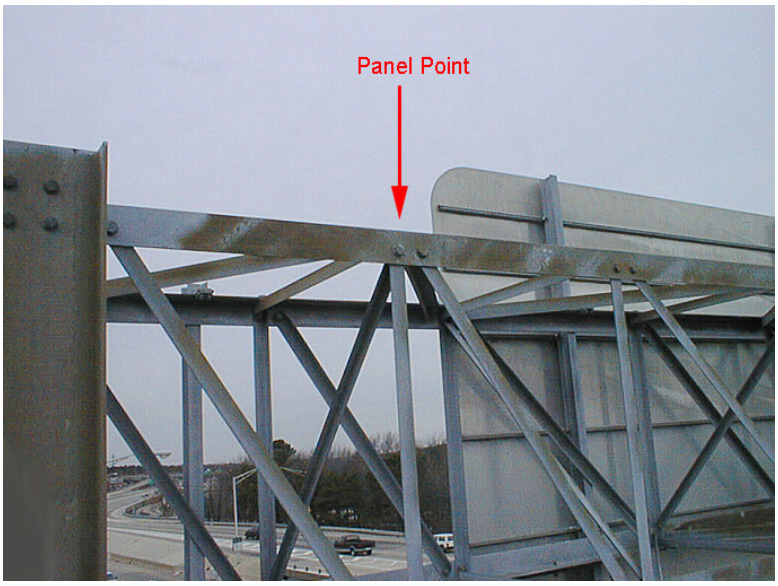


Photo 2 - Close-up View of a Panel Point

Long overhead span structures are formed by joining separate sections of space frames. For round chords, splice flanges are welded to the chords at the end of each of the frame sections. The frame sections are field bolted together at the splice flanges. Photo 3 shows a typical round chord splice connection.

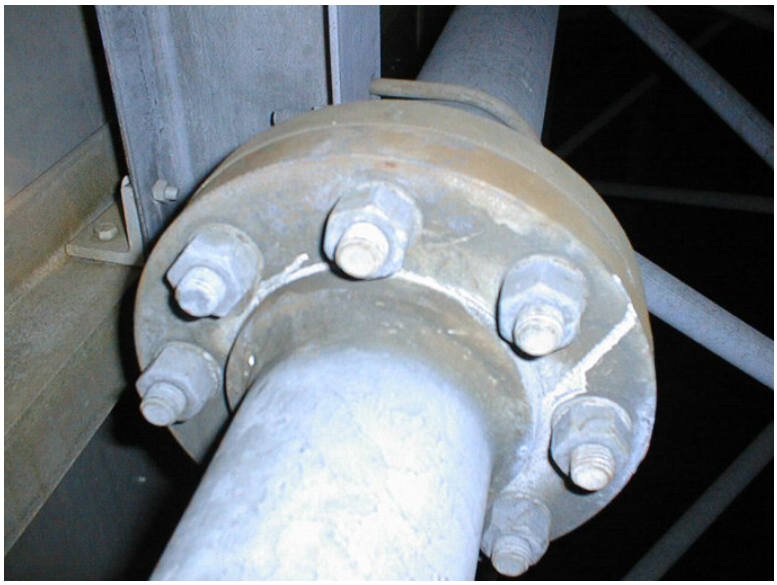


Photo 3 - Typical Round Chord Splice Connection

For angle chords, the splices are made by bolting or welding the chords to a short section of angle that overlaps each chord section. Photo 4 shows an angle chord splice connection.

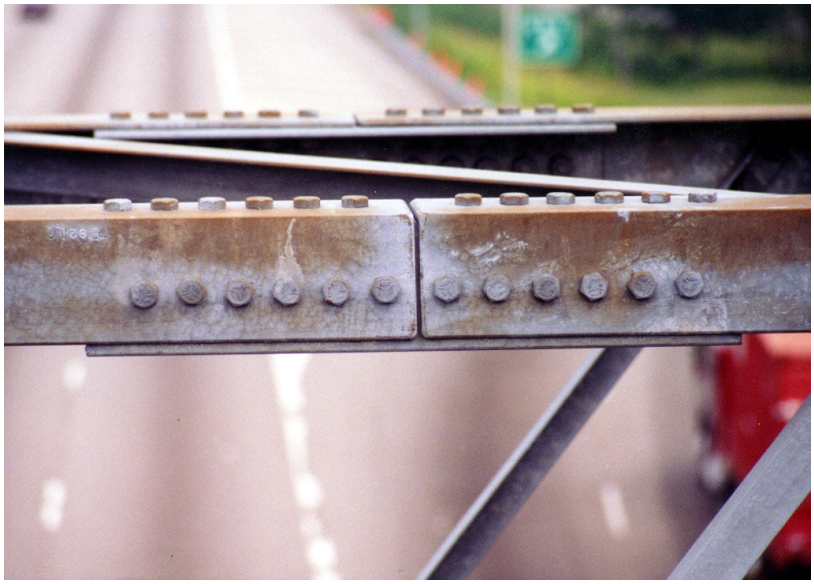


Photo 4 - Example of an Angle Chord Splice Connection

The ends of bottom chords are attached to the pole by U-bolts. The ends of top chords may or may not be attached to the pole by U-bolts. Figure 1 shows details of a space frame and terms used in describing a space frame.

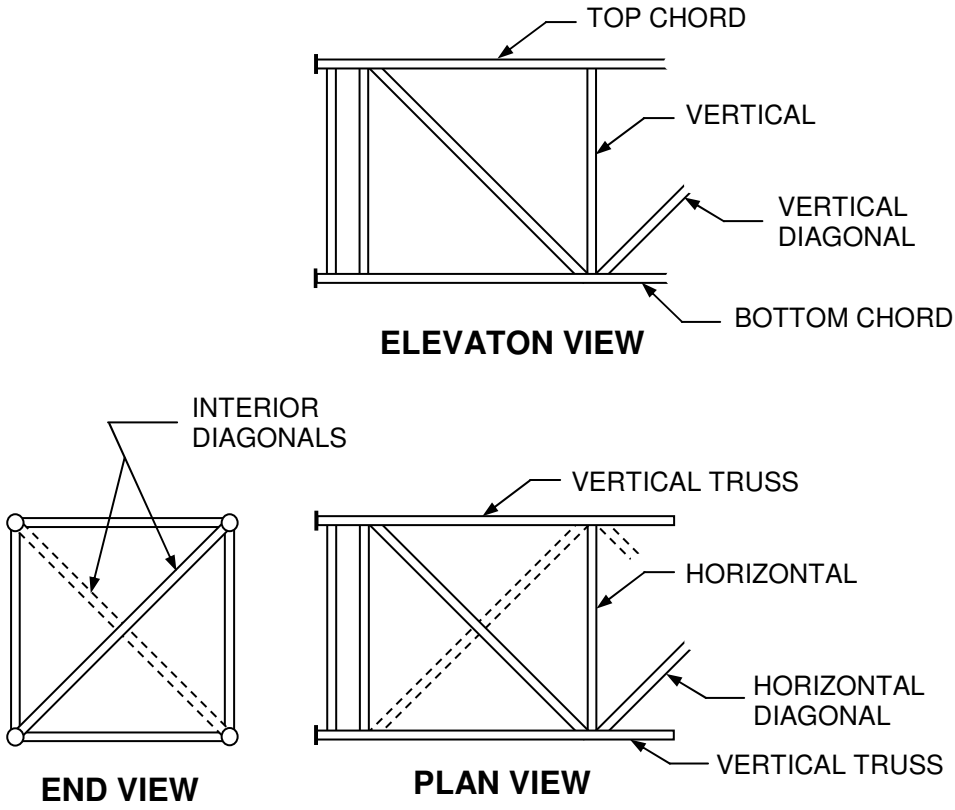
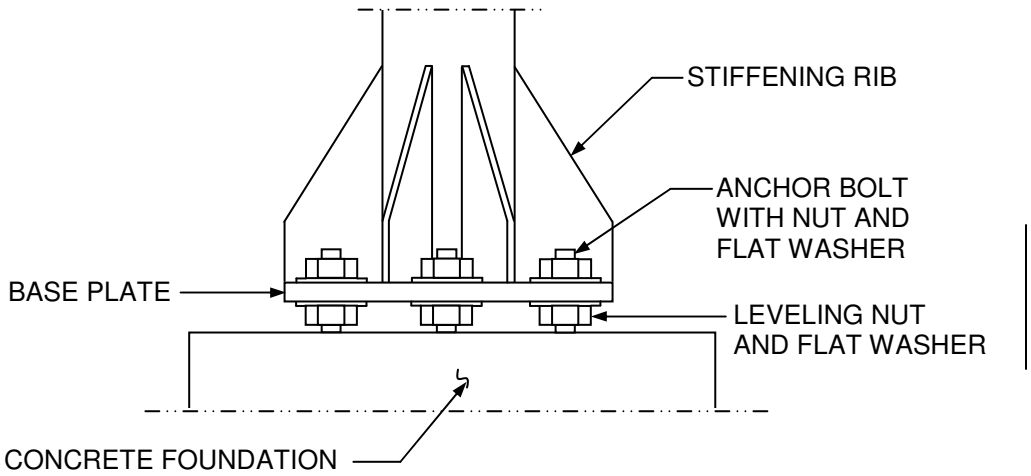


Figure 1 - Details of a Space Frame

Each two-pole support frame consists of two poles connected by horizontal members and diagonal bracing members. Photo 5 shows an end view of an End Frame

Photo 5 - Typical End Frame

The base plates are welded to the poles and are bolted to the concrete foundations using anchor rods embedded in the concrete. The base plate rests on leveling nuts on the anchor rods. The practice of placing grout under the base plate is no longer approved in Virginia. It is possible that sign structures that have been in place since the 1970's may have a thin (1/2" or less) grout pad that was used at that time for leveling. Figure 2 shows presently typical details of a bearing of a support frame and Figure 3 shows simple truss support details.



PART ELEVATION VIEW

Figure 2 - Details of a Bearing of a Support Frame

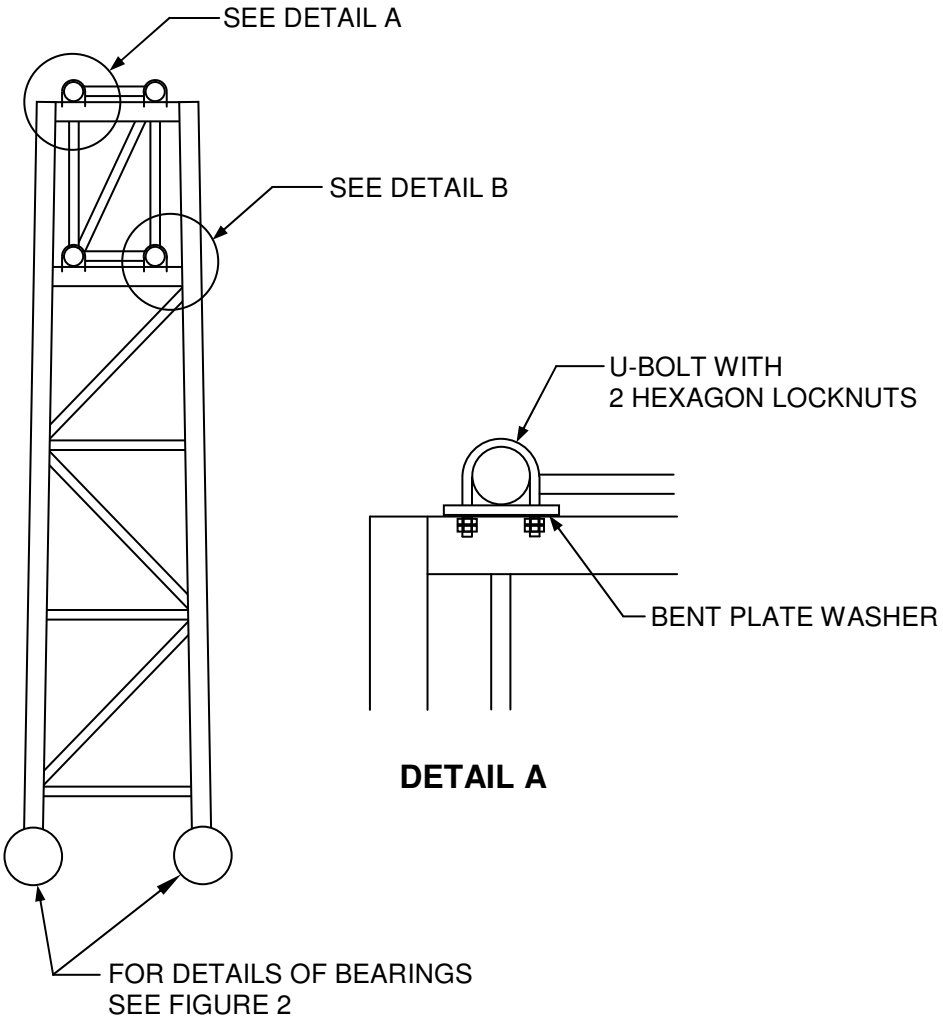


Figure 3 - Simple Truss Support Details

Photos 6 and 7 show foundations for overhead span sign structures.

Photo 6 - Foundation for an Overhead Span Sign Structure

Photo 7 - Foundation for an Overhead Span Sign Structure

Tri-Chord Overhead Span Sign Structures

The tri-chord overhead span sign structure is similar in basic concept to the four-chord overhead span sign structure. The notable difference between the four-chord and the tri-chord designs is that instead of having a second parallel truss to form a space frame, the tri-chord design utilizes a single chord behind the front vertical truss, which is connected with diagonals to the top and bottom chords of the truss to form the space frame. In cross-section, the tri-chord space frame resembles an equilateral triangle.

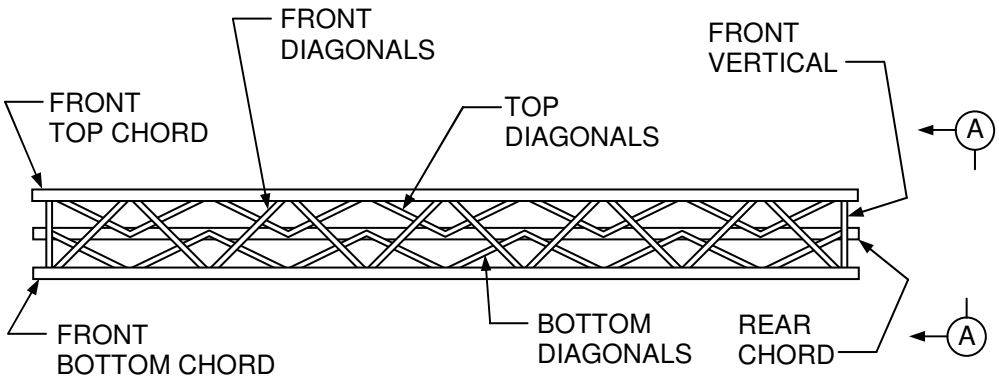
The tri-chord overhead span sign structure may be supported at each end either by a two-pole support frame or by a single-pole support.

Photos 8, 9 and 10 show views of tri-chord overhead span sign structures. Figure 4 shows typical details of tri-chord sign structure installed in Virginia.

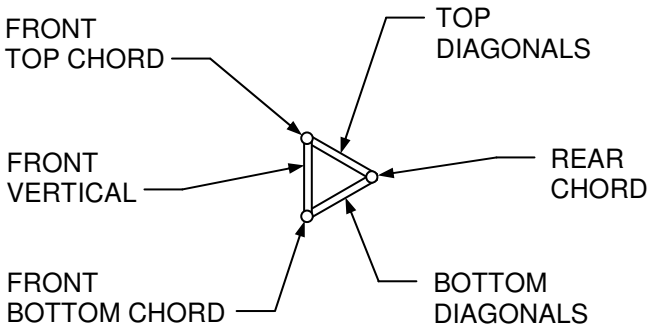
Photo 8 - Tri-Chord Overhead Span Structure on Two Single-Column Supports

Photo 9 - Tri-Chord Overhead Span Structure on Two Double-Column Supports

Photo 10 - End Frame of a Tri-Chord Overhead Span Sign Structure on Two Double-Column Supports



ELEVATION VIEW



VIEW A - A

Figure 4 - Typical Details of a Tri-Chord Sign Structure Installed in Virginia

Two-Chord Overhead Span Sign Structures

The two-chord overhead sign structure consists of a single vertical parallel-chord plane truss that is supported at each end by single-pole support. The details of the truss are similar to those of the four-chord design.

Photo 11 shows one type of a two-chord overhead span sign structure. The two-chord structure consists of two chords connected with angles. The truss configuration is a Pratt truss. The chords are connected to the poles with a separate U-bolt clamp around the chord and the pole.

Photo 11 - One type of a Two-Chord Overhead Span Sign Structure

Single-Chord Overhead Span Sign Structures

The single-chord overhead span sign structure consists of a chord that is supported at each end by single-post supports. Photo 12 shows a single-chord overhead span sign structure.

Photo 12 - One Type of a Single-Chord Overhead Span Sign Structure

2.2 Cantilever Sign Structures

Four-Chord Cantilever Sign Structures

The four-chord cantilever sign structure consists of a three-dimensional space frame rigidly supported at one end by a single cantilever pole. Photo 13 shows a rear view of a four-chord cantilever sign structure.

Photo 13 - Rear View of a Four-Chord Cantilever Sign Structure

Each of the four chords is attached individually to the support pole. Typically a horizontal plate is welded to the top of the pole. Two separate smaller plates are welded to the pole, one on the front and one on the rear, at the elevation of the bottom chords of the truss to be mounted.

Welded to the bottom of the cantilever pole is a base plate that is attached to the concrete foundation with anchor rods embedded in the concrete footing. Figure 5 shows typical details for a space frame support pole on a cantilever sign structure. Photo 14 shows a typical foundation for a cantilever sign structure.

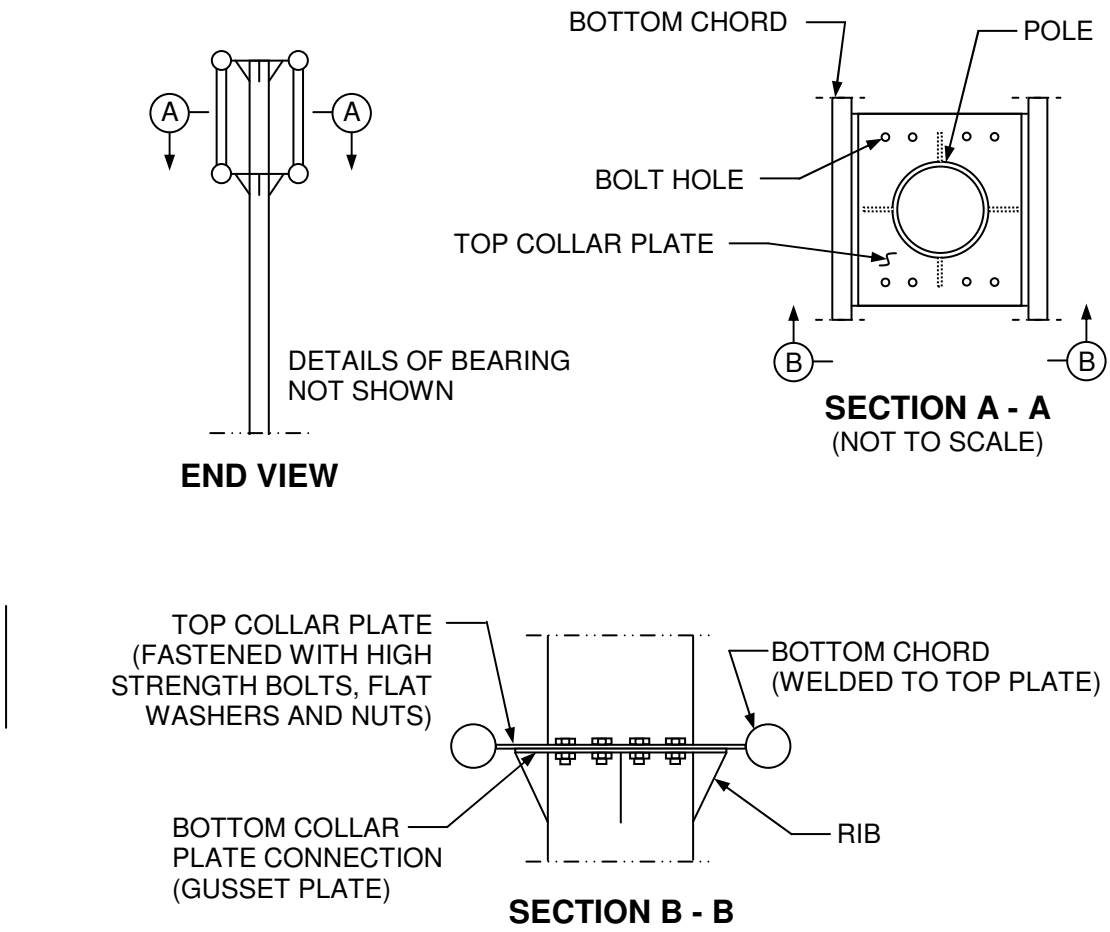


Figure 5 - Typical Details for a Space Frame Support Pole on a Cantilever Sign Structure

Photo 14 - Typical Foundation for a Cantilever Sign Structure

Two-Chord Cantilever Sign Structures

The two-chord cantilever sign structure may consist of trussed or untrussed chords. A vertical flange plate is welded to the supported end of each chord. The pole support consists of two flange plates welded onto the pole. The chord flange plates are connected to the flange plates mounted on the pole support by bolts. Photo 15 shows a view of a connection.

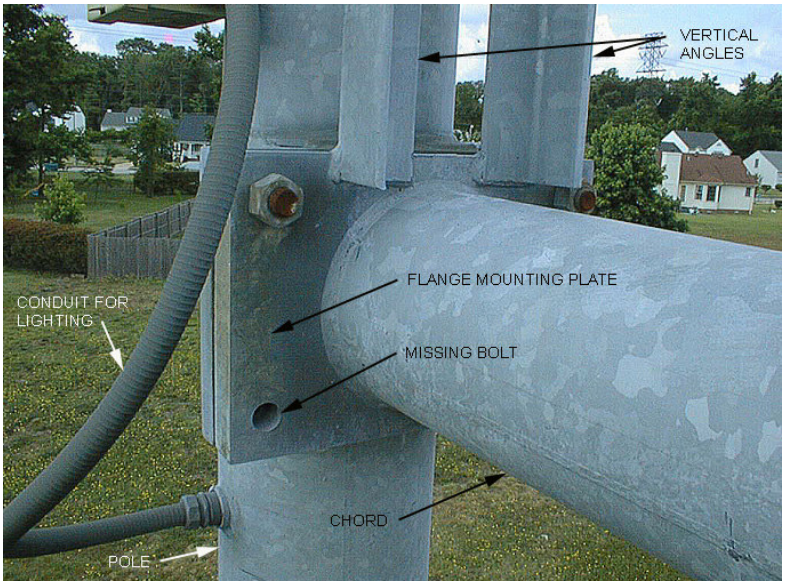


Photo 15 - Connection of Chord Flange Plates to Flange Plates on Pole Support

Single-Chord Cantilever Sign Structures

Single-chord cantilever sign structures consist of a single horizontal chord supported by a single cantilever pole. Photo 16 shows a single-chord cantilever sign.

Photo 16 - A Single-Chord Cantilever Sign

2.3 Bridge Parapet Mounts

Bridge parapet mounts consist of a support fabricated with angles, wide flange, or T-sections. The bottom members are attached to the web of the bridge beam/girder with a bolted connection. Connections to the bridge beam/girder should never be made by welding. The top members may be attached to the bridge parapet or edge of slab with anchorage. Photo 17 shows a view of a typical bridge parapet mount and connection details.

Photo 17 - Typical Bridge Parapet Mount Connection Detail

2.4 Butterfly Sign Structures

There are various configurations of butterfly frames. Each configuration will relate to a previously discussed structure. Photos 18 and 19 each shows a butterfly sign structure.

Photo 18 - A Butterfly Sign Structure

Photo 19 - A Butterfly Sign Structure

2.5 High Mast Lighting Structures

High mast lighting structures are cantilever poles made up of sections. The pole heights normally range from 50 to 175 feet. High mast structures support a ring of lights that illuminate a large area. The ring can be lowered and raised with either an internal or an external winch. Splices between sections may be butt-welded or overlapped slip joints. Photo 20 shows a high mast lighting structure. The structures are secured to a concrete foundation with anchor rods and leveling nuts. Photo 21 shows a high mast structure base.

Photo 20 - Typical High Mast Lighting Structure

Photo 21 - Typical High Mast Structure Base

2.6 Camera Pole Structures

Camera pole structures consist of cantilever poles that may be manufactured as one section or made up of sections. Camera poles normally range from 35 to 65 feet. Photo 22 shows a typical camera pole. Pole sections are spliced together by slip joints. The pole is secured to a concrete foundation with anchor rods and leveling nuts. In addition to the camera that is mounted at the top of the pole, the pole supports a walkway for maintenance and inspection purposes.

Photo 22 - Typical Camera Pole

CHAPTER 3

COMPONENT INSPECTION GUIDE

3.1 Introduction

A qualified inspector must know what defects and deficiencies to look for during an inspection and must understand which conditions present an existing/potential hazard to the public's safety. This chapter will describe the materials used to construct the sign structures and explain the types of deterioration and causes of deterioration typically found on the structures.

3.2 Steel Components

Steel in properly engineered shapes has relatively high tensile, compressive and shear strengths. Most steel used in traffic control devices is mild carbon steel that is widely used in building and bridge construction. Steel is relatively ductile but can become brittle due to metal fatigue. This mild carbon steel is readily weldable. Carbon steel is not resistant to atmospheric corrosion and rusts when it is left unprotected. Therefore, most steel structures are galvanized. Weathering steel has also been used for high mast lighting structures and sign supports.

Typical problems found with the steel components in sign structures include rust, cracks in members or welds, buckles, ruptures, separation of members, looseness, sheared or deformed bolts or rivets, galvanic corrosion, and collision impact damage. Photos 23 through 27 shows some typical problems of steel members found by inspectors.

Photo 23 - Broken Bolt

Photo 24 - Impact Damage

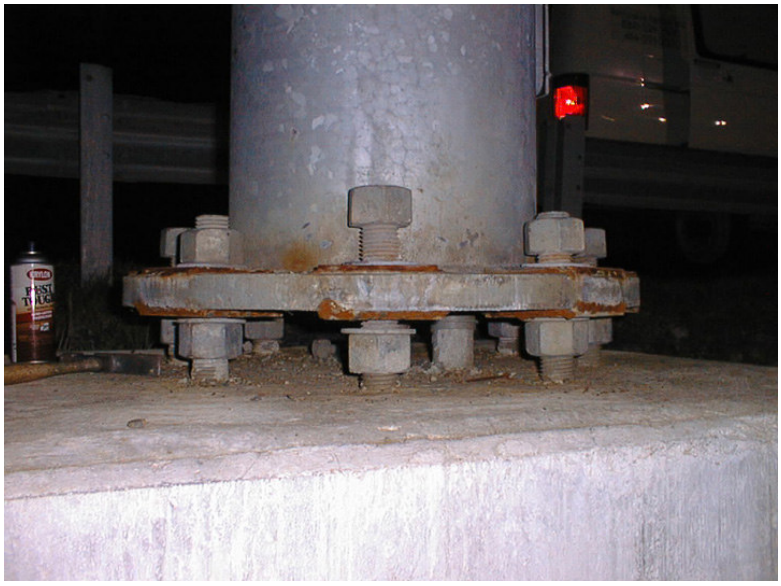


Photo 25 - Loose Anchor Nuts

Photo 26 - Missing Splice Connection Bolt

Photo 27 - Deteriorated Grout and Corrosion on Anchor Rod

There are a number of causes for the problems found with the steel components: member fatigue, restrained thermal expansion or contraction, vehicular collisions, welds of poor quality, inappropriate choices of welding techniques, deicing salts, galvanic corrosion, loss or lack of protective coating (galvanizing or paint) and stress concentrations caused by poor design details. Examples of poor detailing include sharp angular cuts for re-entrant corners, abrupt changes in member width or thickness, heavy concentrations of welds or insufficient bearing areas for a support. Overstress of members is a less common cause of problems.

3.3 Aluminum Components

Compared to steel shapes, aluminum has moderate tensile, compressive and shear strengths. Aluminum is highly resistant to atmospheric corrosion and weighs approximately one third as much as steel. Aluminum is easily fabricated but requires special procedures for welding. Aluminum can become brittle due to metal fatigue.

Typical problems that are found with the aluminum components include buckled, ruptured, separated or cracked members, cracked or incomplete welds and collision impact damage. Porous castings are a particular problem to aluminum components. Additional problems can be caused by restricted thermal expansion or contraction, trapped water freezing and bursting the members, stress concentrations due to the misalignment of fabricated sections or poor design details or member and weld fatigue caused by wind vibration. Photo 28 shows a cracked chord member in an aluminum space frame.

Photo 28 - Cracked Chord

3.4 Concrete Components

When properly designed, mixed and cast into engineered shapes concrete has high compressive strength but, compared to steel and aluminum, relatively low tensile and shear strengths. The strength of concrete can be increased in tension and shear by placing reinforcing steel bars or prestressed steel wires in the concrete when it is cast. Concrete is porous and permeable which permits absorption of water by capillary action and the passage of water under pressure.

Concrete's durability depends on climate, exposure, reinforcing steel bar protection (bar coating and concrete cover) and the proportions of the materials used in the mix.

Indications of concrete deterioration on the foundations include cracking, scaling, efflorescence or encrustation at the surface of cracks, exposed reinforcing steel, corroded reinforcing steel, and delaminations (hollow sounds when the surface of the concrete is tapped with a hammer). Problems found with the foundation grout include cracks, voids and loose grout. Problems with anchorage include bent or corroded anchor rods, missing washers, loose or missing nuts, and fatigue.

Sources of concrete deterioration

- Freeze-thaw cycles
- Deicing salts
- Differential thermal strains
- Unsound aggregates used in the mix
- High alkali cement reacting with the aggregates (alkali-silica reactivity)
- Dissolution of calcium hydroxide from the concrete by seeping water (efflorescence)
- Chemical attack
- Collision impact damage
- Foundation movements (erosion)
- Concrete shrinkage
- Tensile flexural stresses
- Expansion of the reinforcing steel due to rust
- Poor consolidation of the concrete causing honeycombing

Sources of grout problems include poor grout mix; poor consolidation; freeze-thaw cycles; poor installation; and the action of deicing salts.

Sources of anchorage problems include misaligned anchor rods during construction (failure to use template), poor or damaged coating, significantly corroded bolts and incorrect or poor tightening methods. Photos 29 through 32 show typical foundation problems.

Photo 29 - Honeycombing of Concrete Pedestal

Photo 30 - Spall at Corner of Concrete Pedestal

Photo 31 - Undermining at Edge of Concrete Pedestal

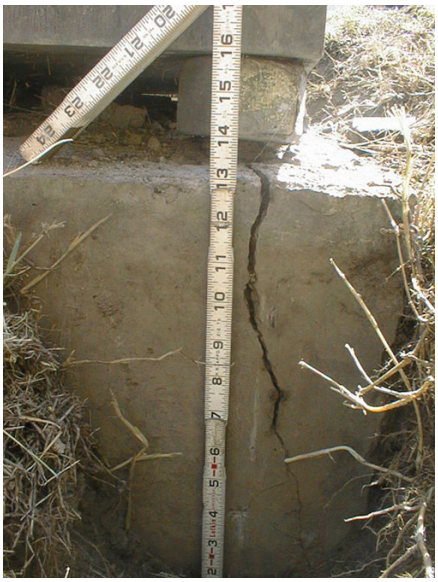


Photo 32 - Vertical Crack in Concrete Foundation

3.5 Component Inspection

This section describes tips and methods used to identify problems with individual components. Photographs are to be taken at locations of all significant problems. When placed in the report the photograph shall also have appropriate verbiage describing the problem.

Appearance

The entire sign structure should be examined "from a distance" looking for obvious deficiencies or problems. The inspector should check for:

- Gross damage to the structure and its supports from collisions.
- Negative camber (sag) of overhead span structures
- Overall extent of corrosion on steel structures, noting percentage of structure affected
- Alignment of the members.
- Vertical under clearances (minimum) over each shoulder and each lane.

Foundations and Grout Pads

VDOT no longer approves of the practice of placing grout around the anchor rods and under the base plate of the pole.

Concrete foundations should be visually inspected and sounded with a hammer. For an overhead span sign structure with a space frame, inspect both foundations prior to climbing. This ensures that one is not forgotten after the structure is inspected.

- Determine if there has been erosion or undermining at the footing.
- Determine type of footing, if possible.
- Examine the footing for impact damage, spalling, scaling, and/or cracking. Most cracking is visible to the naked eye. However, cracking causing delamination will be below the surface. Therefore, the concrete must be tapped with a hammer to locate delaminations. The delaminated areas will give a hollow sound when tapped with a hammer. Photo 33 shows an inspector sounding a grout pad.

Photo 33 - Inspector Sounding a Grout Pad

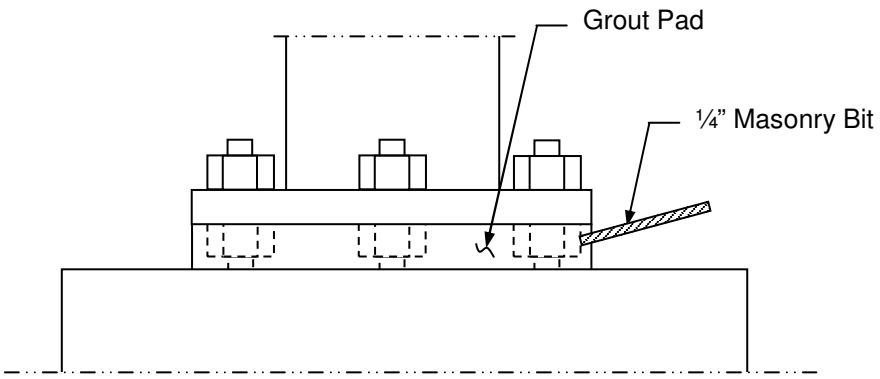
- Measure the grout thickness and note the thickness on the inspection form.
- Note on the inspection form if a leveling nut is present and its condition, if its condition can be determined. A deteriorated grout pad and no leveling nut could be a serious condition and should be reported immediately to the District Structure and Bridge Engineer or their representative.

  To determine if a leveling nut is present the inspector can 'probe' the grout pad by using a 1/4" masonry bit to drill a hole in the grout pad. The hole should be drilled toward the anchor rod and in a direction that would intersect a leveling nut, if one is present. The inspector shall take all precautions not to hit the anchor rod and to minimize damage to the leveling nut, if one exists. A measurement taken from the anchor nut to the outside of the baseplate will give the inspector a dimension to be used to minimize damage to the leveling nut or the anchor rod. Whether a leveling nut is present or not the hole in the grout shall be filled with caulk prior to leaving the site. If the grout is in poor condition the inspector may be able to remove a section of grout rather than drill a hole. See sketch below.
- Note the extent of cracking, efflorescence, or deterioration of grout pads.

  If there is deterioration of the grout pads, do NOT recommend any repair. Recommend removal of deteriorated grout.
- Note if there is any evidence of moisture in damaged grout pads.

Evidence of a deteriorated grout pad and no evidence of a leveling nut is a serious situation that should be reported immediately to the District Structure and Bridge Engineer.

All deficiencies should be fully quantified by describing the type (spall, crack, etc.), location and size (length, width, depth, etc.) of the defect. For example, the location of exposed reinforcing steel should be noted, as well as the severity of any corrosion that has taken place. If the corrosion has caused section loss, the section loss should be quantified.



PART ELEVATION VIEW

Figure 6 – Drilling Grout Pad to Determine Existence of Leveling Nuts

Anchor Rods

A sign end support (frame or pole) will be attached to the foundation with anchor rods. Existing anchor rods may be double nutted, or have lock nuts or lock washers. Flat washers should be used under the anchor and leveling nuts. The distance between the bottom of the base plate and top of pedestal shall be less than or equal to the diameter of the anchor rod plus one inch. If anything contrary to these conditions is observed, it should be noted. Photo 34 shows an inspector sounding an anchor rod, anchor rod nut and washer and Photo 35 shows a nut not fully engaged on a base plate connection.

- If anchor rods are buried, fill should be removed for the inspection. Note presence of fill in commentary.
- Determine the anchor rod size so replacement parts can be identified.
- Note the presence of split or lock washers.
- Note the presence of lock nuts.
- Note the anchor rod configuration, number of rods, if leveling nuts are present and type of washers used.
- Note any missing components, such as washers or nuts.
- Check components for corrosion, deterioration (note section loss), loss of galvanizing, etc.
- Visually check the plumbness of the anchor rods.
- Check for enlarged holes in base plates due to improper placement of anchor rods.
- Check for inadequate size of washers due to enlarged holes in base plates.
- Check that the nut is adequately threaded on the rod.
- All anchor rods on four-rod anchorage systems on all cantilevers, high mast light poles, butterfly poles and overhead spans where the end supports consist of single poles shall be inspected using ultrasonic testing at each inspection to check the anchor rods for potential cracks.
- Tap the anchor rod nuts and washers to check for looseness.

  The anchor rod nuts must be tight to clamp the base plate to the foundation (or leveling nut). A loose washer will reveal an unclamped anchor rod even if the rod is tight on the anchor rod. When loose anchor rod nuts are encountered, the inspectors should tighten the nuts to a "snug-tight" condition using hand wrenches. Do not force nuts that bind or otherwise become difficult to tighten.

- For structures having anchorage systems of more than four rods, tap the top of each anchor rod with a hammer. A dull or hollow sound may indicate the presence of a cracked anchor rod.

  If a crack is suspected, an ultrasonic test should be conducted to verify the presence and location of a crack

Base Plates

The base plate is a separate inspection item.

- If base plates are buried, fill should be removed for the inspection. Note condition of fill in commentary.
- Check base plate for corrosion, deterioration (note section loss), loss of galvanizing, etc.
- Check for distress in the base plate around any welds.
- Conduct magnetic particle testing on any base plate-to-pole welded connection for variable message signs.
- Check for distress around enlarged holes for the anchor rods. Holes are sometimes enlarged to facilitate installation of the base plate, due to improper installation/setting of anchor rods during construction.

Photo 34 - Inspector Sounding an Anchor Rod and Washer

Photo 35 - Anchor Rod Nut Not Fully Engaged

Vertical Frame or Pole Supports and Connections

Typically, the end supports for overhead and cantilever signs will be single poles or vertical frames. For frames, the vertical chords will be designated as poles. For single supports, the member will be designated as a pole.

- Visual inspection of vertical frame supports should detect most deficiencies such as corrosion; buckled, bent, ruptured, cracked or missing members; and cracked, incomplete or excessively-ground welds; and gusset plate cracks.
- When coating loss (paint or galvanization) or other surface corrosion is observed, the adjacent area should be sounded with a hammer. In addition, the support should be sounded. These areas should be sounded as they may indicate, or be more susceptible to, internal rusting of the members, leading to either partial or complete section loss. This condition is most often found around the base of the supports. Internal rusting also causes weep holes to be blocked with rust scale, thereby trapping moisture and intensifying the problem. The weep holes should be checked for scale, and cleared out whenever possible. If an area is suspected or exhibiting internal rusting, then the remaining thickness of the member should be determined. An ultrasonic thickness gage (D-meter) should be used in and around the suspected areas to determine the extent (if any) of section loss.
- On painted structures, isolated areas of cracked or splitting paint can be an indication of an overstressed section. These areas should be closely examined for other signs of distress and noted on the report.
- The connections of the spans to the support frames should be visually inspected. All deficiencies should be recorded
    1. Bolted connections should be checked for tightness. Typical problems that may be encountered include missing U-bolts; missing or shifted saddle shims; loose nuts on the U-bolts; bolts that are not long enough to fully engage all of the threads of the nuts; shifted or deteriorated bearing pads under the pillow blocks; and oversized holes (cut in field) for the U-bolts. Any burned or otherwise rough holes should be closely inspected for cracks.
    2. Welded connections should be checked for cracks
- Check weepholes for blockage (if applicable).

- Open hand-holes, if possible, and check for obvious deficiencies such as cracks around the hand-hole, moisture accumulation and broken welds. The size and placement of the hand-hole will determine how much information can be obtained. CAUTION: Hand-holes can provide access to electrical items use care to prevent electrical shock.
- Check for missing caps on posts.
- Examine any joints or splices in the poles.
- Vertical pole supports should be inspected similar to the support frames. The pole supports have a full moment connection with the span. All nuts and bolts should be hand checked for tightness. Loose bolts can cause some of the connection plates to bend or shift and should be inspected closely.

Connections Between End Supports and Vertical Truss/Space Frame

There are various methods of securing a vertical truss or space frame to the end supports with welding and bolting being the most common.

- Hand check bolts for tightness.
- Check for missing or deformed components.
- Visually examine any welds.

Overhead or Cantilever Spans

During the inspection, reference points should be marked on the structure with chalk, keel, or permanent marker. These reference points are useful for describing the location of damaged or deteriorated members. Corroded areas may need to be checked for internal rusting by a D-meter as described for the vertical frame supports.

The chords are the primary structural members.

- Check alignment
- Check for buckled, ruptured, cracked, bent or missing members.
- Check for corrosion or breakdown of galvanization.
- Check for cracks and/or structural damage (from impact or installation procedures).
- Check for missing covers over the ends of the chords.
- Check for incomplete, excessively-ground, or cracked welds
- Measure the span length or length of the cantilever arm.

Flange splice connections are commonly used to connect space frame sections.

- Check for corrosion or breakdown of galvanization on bolts and nuts.
- Handcheck tightness of bolted connections.
- Check for cracks.
- Check welded connection between the chord and the flange splice.

The secondary-trussing members (horizontals, verticals, and diagonals) are used to transfer loads and provide stiffness.

- Check for incomplete, excessively-ground, or cracked welds
- Check for buckled, ruptured, cracked, bent, deformed or missing secondary members.
- Check corrosion or breakdown of galvanization.
- Check tightness of bolted connections by hand or by tapping lightly with a hammer.

Bridge Mounting Hardware

All members and connections of bridge mounts should be inspected as described above for similar components found in the bridge mount. In addition:

- Check bolted connections between the support frame and the parapet or deck for soundness.

    - Check the mounting hardware for corrosion
    - Check the concrete surrounding the bolted connection for deterioration, cracking and bolt pull-out.
- Inspect bolted connections between the support frame and the bridge beam/girder.
    - Check the bridge beam/girder material surrounding the connection for signs of distress.
    - Check all bolted connections for tightness and full engagement of the nuts
- Note exposed anchorages on traffic side of parapet.

Signs, Sign Brackets and Sign Clips

The sign panels are typically connected to the brackets or to hanger angles with clips. Photo 36 shows the sign clips and the vertical and horizontal sign support angles.

- Inspect all connections between the back of the sign panels and the mounting components, i.e. the backing strips, wind beams, or hangers. Bolts, pop rivets and sign clips are all fastener types that can be encountered on the backs of signs. For bolts, handcheck the tightness of each nut. Tighten to the "snug tight" condition any loose sign backing nuts. Where there are missing fasteners, note the number and location of missing fasteners and identify a percentage of the total fasteners that are loose.
- It should be noted if there has been a retrofit of the sign panel to structure connections.
- Check hanger connections to chords for corrosion, tightness, and full engagement of the nuts.
- Measure the area of each sign on the structure.
- Signs should be visually inspected for peeling or delamination of the sign letters or sign overlays, loose sign edging and sign vandalism. When signs with defects are encountered, the specific sign panel involved should be photographed or the message sketched with the location(s) of the defect(s) noted.
- Any attempts to retrofit the attachment of the sign panels to the supporting structure should be noted.

Photo 36 - Sign Clips and Vertical and Horizontal Support Angles

Walkways and Safety Railings

Due to safety concerns, at this time walkways are not to be used for inspection of the sign structure. Access to portions of the sign structure must be made by means other than the use of the walkway or climbing on the structure.

Walkways are inspection and maintenance aids which are mounted on cantilever or overhead span sign structures. Walkways can usually be accessed from the supporting space frame; however, at times the sign extends beyond the end of the walkway, making access difficult or impossible without the use of a bucket lift.

- Measure the length of the walkway.
- Check for obvious impact damage.
- Check for tripping hazards due to uneven grating elevations and misaligned grating sections.
- Check for corroded connection bolts.
- Check the connections between the support brackets and the structure's chords for tightness and corrosion.
- Check handrails for proper operation, gaps, missing hinge bolts; missing or misaligned locking pins and holes; stability; proper operation; and corroded chains for locking pins. All handrails should always be equipped with locking pins.
- Check safety chains for latches that are rusted shut, inaccessible safety chains, latches that cannot be opened and corroded or missing chains. Note that all handrails should be equipped with safety chains.

Lighting

In general, the sign structure inspections do not cover the structure's lighting or wiring; however, the inspector is required to note anything that may pose a threat to the safety of the public whether motorists, pedestrians, or inspection personnel. Included within this responsibility, the inspector should:

- Check luminaire mounting arms for integrity.
- Check connections between the support arm and the chords.
- Check connections between the luminaire (head) and the support arm for tightness and corrosive deterioration.
- Check wiring conduits for any broken or damaged sections or exposed wiring.
- Check around any drilled holes for areas of distress or water infiltration.
- Check LumiTrak^{Tm} to see if operational by attempting to move the LumiTrak^{Tm} a short distance. Do not walk on LumiTrak^{Tm}.

CHAPTER 4

MAINTENANCE GUIDELINES

4.1 Introduction

The team leader is required to recommend repairs for each structure and indicate a time frame within which the repairs should be accomplished. The team leader should be assessing repairs in terms of emergency situations: high priority, medium priority, or low priority. Refer to Appendix A for determining maintenance needs for the sign structures.

Emergency situations are those in which there is an immediate danger to the traveling public. The following shall be immediately notified of any emergency situations are found:

- The appropriate District Structure and Bridge Engineer
- The appropriate Residency Administrator
- The appropriate District Traffic Engineer

High priority repairs are differentiated from emergency repairs in that there is a potentially dangerous situation but there are no visible indications of distress in critical members or their connections. An example of a high priority repair would be a loose anchor rod nut for a six-rod configuration base plate of a single pole cantilever sign. In this case, the nuts should be tightened and nondestructive testing should be performed on the anchor rods and the column-to-base plate weld. High priority repairs are also to be recommended to the District Structure and Bridge Engineer by the inspection team in a timely manner. Judgment must be used in assessing the importance of the condition when deciding on how to contact the appropriate personnel. Note that indications of distress in the rods or in the base plate to pole welded connection would make the preceding problem an emergency situation.

Medium priority repairs cover deficient components that do not immediately threaten the public, such as: ruptured or cracked secondary members, minor walkway or handrail defects, etc.

Low priority repairs cover components with minor structural deficiencies, such as: minor loss of protective coating (galvanizing, paint), minor foundation cracks, minor cracks in secondary members, displaced saddle shims, one or two missing/sheared sign backing bolts, etc.

The District Structure and Bridge Engineer or their representative shall review the maintenance recommendations of the team leader and evaluate the appropriateness based on the conditions presented in the report. It is essential that the inspectors obtain adequate documentation (including photographs) so the reviewing engineer will have a complete and accurate assessment of the conditions in the field.

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GLOSSARY

Additional Inspectors — All other individuals participating in the field inspection of the structure.

Anchor Rod — A bolt-like piece of metal commonly threaded and fitted with a nut, or a nut and washer at one end only, used to secure in a fixed position the end of a truss, the base of a pole, pedestal, shoe, or other member of a structure.

Axial Stresses — Stresses acting parallel to the member.

Backing Strip — A strip of metal attached with rivets or bolts connecting adjacent sign panels.

Base Plate — A piece of steel, which is welded and made an integral part of the base portion of a pole or other member. It is used to transmit and distribute a load directly or otherwise either to the substructure or to another member.

Brittle — Property of a material that can undergo only a small amount of plastic deformation before breaking. It is not related to strength.

Buckle — Failure by an inelastic change in alignment (usually a result of compression).

Buckling — The lateral and/or twisting deformation that occurs normal to the load in a compression member that creates a plastic change in the alignment.

Bulb (Bulb Matrix) — This type of VMS sign utilizes light bulbs arranged in rows and columns. Messages are displayed by activating a predetermined number of bulbs.

Camber — A vertical arch built into a space frame by lengthening the top chord members of the frame during fabrication to compensate for dead load deflection.

Camera Pole — A long vertical cantilever beam supporting surveillance equipment.

Cantilever — A beam, truss, or slab (horizontal or vertical) supported at one end only.

Capillary Action — This is the movement of a liquid caused by the attraction or the repulsion between a solid and a liquid. Due to this force porous materials soak up liquids and liquids rise between narrow spaces.

Chord — The upper and lower members of overhead span and cantilever sign structures carrying the tensile and compressive forces resisting moments.

Chord Members — Part of a truss. The corresponding members of the chords are described as upper, or top, chord members and lower, or bottom, chord members.

Chord Type

The type of chord present shall be represented in the inventory by an alpha code. See the table below.

A -	Single arm
B -	Double arm – untrussed
C -	Double arm – trussed
D -	Tri-chord
E -	Box truss
F -	Vierendeel truss - 2 chord
G -	Vierendeel box truss - 4 chord
H -	Not applicable

City

A three-digit code indicating the city that maintains the structure, if applicable. The structure may reside within a city's limits but is maintained by a county. In that case, this will be the city where the structure is geographically located. It is also possible that the structure resides within a county and is maintained by that county. In that case, this item will be coded 'N/A'.

Clearance

The horizontal or vertical distance to an obstruction.

Comments

Where applicable, these fields are used to make comments on items that need further clarification and/or quantification.

Concrete

A mixture of aggregate, water and a binder, usually Portland cement, which hardens to a stone-like mass.

Contractor

This field contains the name of the contractor taken from the plans and data submitted by District Traffic Engineer.

Corrosion

The general disintegration and wasting of surface metal or other material through oxidation, decomposition, etc.

County

A three-digit code that indicates the county that maintains the structure, if applicable. It is possible that the structure resides within a municipality's limits but is maintained by a county. In that case, this will be the county that maintains the structure. It is also possible that the structure resides within a municipality's limits and is maintained by that municipality. In that case, this item will be left blank.

Date of Inspection

The month, day and year that the structure was inspected (mm/dd/yyyy).

Date Erected

This field contains the month and year (mm/yy) the structure was erected.

Dead Load

A static load due to the weight of the structure itself.

Deformation (elastic)

Deformation occurring when the stress in a material is less than the yield point. If the stress is removed, the material will return to its original shape.

Delamination

A separation of a material into layers. In concrete, this can be caused by the expansion of reinforcing steel.

Depth of Truss As applied to trusses having parallel chords it is the vertical distance between the centerlines of the top and bottom chords.

Diagonals The members that extend from the lower corners of each panel up to the opposite upper corners in the panel.

Differential Thermal Strain The strain caused by adjacent portions of a material expanding or contracting at different rates due to a change in temperature
.

Disc This type of VMS sign utilizes a sign-bearing surface consisting of individual discs arranged in rows and columns. Each disc has a reflective surface and a non-reflective surface with messages being displayed when the reflective surfaces are visible.

Efflorescence The powdery crust that forms on the surface of concrete due to salts that are leached out of the concrete and crystallized due to the evaporation of water.

Element Rating Each element shall have its condition noted by entering G, F, P or N based on the following general descriptions shown below.

G Good condition
No problems. Insignificant cracking, spalling, rusting, etc.

F Fair condition
Structural capacity not affected by any problems.
One or more of the following may be present. Rusting with no measurable section loss, sagging that does not affect minimum vertical clearance, small number of bolts loose or missing, bolts extend beyond face of parapet on the traffic side, minor misalignment of structure, erosion or undermining, minor cracking or spalling of concrete (reinforcing may be exposed), grout prohibits inspection of anchor rods, washers missing from anchor rods, locknuts at anchor rods, loose members, cracked welds, damaged struts frayed cables.

P Poor condition
Structural capacity is affected. Immediate attention may be necessary to keep structure from falling.
One or more of the following may be present. Section loss, sagging that reduces minimum vertical clearance, several bolts loose or missing, buckled or bent primary members, major erosion/undermining, cracking/spalling of concrete (reinforcing may be exposed), grout is spalled/cracked, anchor bolts or nuts are missing, anchor rod(s) loose, cracked welds, loose members, structural members(s) cracked, damaged struts, cables frayed or poorly attached.

N – Not applicable.

Encrustation A hard coating or layer.

Fabricator This field contains the name of the fabricator taken from the plans and data submitted by District Traffic Engineer.

Fatigue The deformation or fracture of a metal due to repeated loading and unloading where the loading remains below the yield stress of the material.

Fiber Optic This type of VMS sign utilizes fiber optic bundles arranged in rows and columns. Messages are displayed by activating a predetermined number of shutter devices to control light output.

Fillet Weld A weld joining intersecting members by depositing weld metal to form a near triangular or fillet shaped junction of the surface of the members.

Flip Disc Hybrid These types of VMS sign utilizes light emitting diodes and flip discs to display a message by activating a predetermined number of hybrid discs.

Footing The enlarged or spread- out lower portion of a substructure that distributes the structure load either to the earth or to supporting piles.

Foundation Type The type of foundation present shall be represented in the inventory by an alpha code. See the table below.

A -	Spread footing
B -	Footing on timber piles
C -	Footing on other type piles
D -	Single caisson (drilled foundation)
E -	Double caisson (drilled foundation)
F -	Other type
G -	Unavailable/unknown (cannot be determined)
H -	Not applicable (N/A)

Fracture Critical Member Structural member or member element subjected to tensile stresses whose failure would probably cause a portion of, or the entire structure, to collapse.

Freeze-Thaw Cycle A continuous process where water seeps into cracks and imperfections in concrete. The water freezes (expanding while it freezes, enlarging the crack), then thawing. As the frozen water thaws, it seeps deeper into the enlarged cracks in the concrete, freezing and repeating the cycle. Over a period of time these cycles will deteriorate sections of the concrete.

Frequency of Inspection The frequency at which the structure is inspected.

Galvanic Corrosion Corrosion caused by an electrical current between two dissimilar metals.

GPS Acronym for global positioning system.

GPS Coordinates The latitude and longitude of the structure taken to the tenth of a second. This is not the same as State Plane Coordinates.

Grout A mortar having a sufficient water content to render it a free- flowing mass.

Gusset	A plate serving to connect the elements of a member or the members of a structure and to hold them in correct alignment and/or position at a joint.
Hanger	Vertical member attached to the chords usually with U- bolts. Also a vertical member attached to the windbeams of a sign panel.
High Mast Tower	Long vertical cantilever beam usually supporting a lighting system. These are normally at heights that exceed 55 feet.
Horizontal Truss	A truss in which all members lie in a horizontal plane.
Howe Truss	A truss having only compression diagonals under downward deflection.
HTRIS Route ID	A route identification noted in HTRIS for structure located to the straight line diagram (SLD). If the route is not located on the SLD leave this item blank.
Inspection Team	All members that compromise the group performing the inspection.
Inspection Team Leader	The individual that leads an inspection team for an inspection on a given date. Typically, the individual must met all the requirements for an individual in charge of a bridge inspection team as set forth by the Federal government in the "Code of Federal Regulations, 23 Highways, Part 650, Subpart C, National Bridge Inspection Standards"
Lane Clearance	This field contains the minimum vertical clearance over each lane, as applicable, to the tenth of a foot accuracy.
Lanyard	A rope where one end is fastened to a safety belt or harness and the other end is secured to a substantial object or a safety line.
Lead Inspector	The typed name and signature of the individual who led the inspection in the field and was present in the field during the inspection. The signature of the lead inspector indicates that the report represents all items found during the inspection and that the inspection conformed to all policies and procedures set forth by the Department.
Light Emitting Diodes (LED)	This type of VMS sign utilizes light emitting diodes (LED) arranged in rows and columns. Messages are displayed by activating a predetermined number of LED's.
Leveling Nut	Nut under the base plate used to level the structure during erection.
Location Description	A narrative description of the location of a structure. It should contain the mileage to the nearest intersection in each direction.
Luminaire	A lighting unit consisting of lamps and parts designed to distribute light and position and protect the lamps and to connect the lamps to the electric supply.
LumiTrak™	A sign lighting system where the luminaires are mounted on a rotating track.
Magnetic Particle Testing	A non- destructive testing technique. In sign inspection, it is used to check for cracks in base plate welds.

Material Type

The type of material used for the pole and chord shall be represented in the inventory by an alpha code. See the table below.

A -	Steel
B -	Aluminum
C -	Fiberglass
D -	Other

Message Type

The type of message shall be represented in the inventory by an alpha code. See the table below.

A -	Standard signs
B -	Variable message (VMS)
C -	Combination standard and VMS
D -	Light only
E -	Signal (traffic signal(s))
F -	Signal(s) and sign(s) (combination traffic signals and signs)
G -	Combination light and other
H -	Other combination(s)

Minimum Vertical Clearance

This field contains the minimum vertical clearance of the structure, in feet, regardless of where it is located (roadway or shoulder). This shall be recorded to the tenth of a foot accuracy.

MOT

Acronym for maintenance of traffic.

Number of Signs/Signals, Etc.

This is the total number of items attached to the structure. Small signs, such as, speed limit signs attached to the pole(s) should not be included in this total. However, these small signs should be noted in the report.

Overall Rating

Enter one of the numeric values shown to describe the severity of the deterioration and/or disrepair of the overall structure.

9	**Excellent condition** Structure is brand new.
8	**Very good condition** No problems noted.
7	**Good condition** Some minor problems
6	**Satisfactory condition** Structural elements show some minor deterioration.
5	**Fair condition** All primary structural elements are sound but may have some minor section loss, cracking, spalling or scour.
4	**Poor condition** Advanced section loss, deterioration, spalling or scour.
3	**Serious condition** Loss of section, deterioration, spalling or scour has seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	**Critical condition** Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed structure support. Unless closely monitored it may be necessary to remove structure from service until corrective action is taken.
1	**"Imminent" failure condition** Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Corrective action may put structure back into service.
0	**Failed condition** Out of service – beyond corrective action

Panel

Each section of the truss that is bordered by an upper chord, lower chord and two adjacent verticals.

Pillow Block

A small cradle-like member attached to the pole in which the bottom chords sit in and are fastened with U- bolts or other type of fastener.

Pole Type

The type of pole present shall be represented in the inventory by an alpha code. See the table below.

A -	Single
B -	Double
C -	Three Poles (span wire)
D -	Four Poles (span wire)
E -	Hybrid (ex. single pole with one side attached to bridge)
F -	Not Applicable

Pratt Truss	A truss having only tension diagonals under downward deflection.
Racking	The distortion and tendency of the panels to lean over as a truss deflects.
Re- entrant Corner	The inside corner of a notch cut into the flange and web of a beam to allow it to frame into another beam.
Redundancy	A property of the structural configuration that allows the applied loads to be redistributed to surrounding members in the event of the failure of any given member or member component.
Reviewed By	The individual in the next higher authority who reviewed the final report. The signature, or initials, and date indicate that this review was completed.
Rotating Drum Sign	This type of VMS utilizes a rotating drum with a finite number of message bearing surfaces. Messages are typically formed by placing reflective sheeting on sign blanks to form a message bearing surface. Messages are displayed by rotating the drum to the appropriate message bearing surface.
Route ID	The route that the structure services. If a structure services overlapping routes, this will be the 'maintenance' route. If the structure is within the limits of an interchange, this will be the route with the highest hierarchy.
Rupture	A bursting/splitting of a material caused by internal pressures. In poles, this can be caused by the freezing of trapped water
Saddle Shim	A thin plate inserted between two elements to fix their relative position and act as a bearing surface.
Scaling	A local flaking or peeling away of the surface portion of concrete or mortar.
Shoulder Clearance	This field contains the minimum vertical clearance over each shoulder, as applicable, to the tenth of a foot accuracy.
Sign	A device designed to convey a specific message.
Sounding	An inspection technique used to detect hollow foundations and cracked anchor rods by tapping concrete foundations and anchor rods.
Space Frame Truss	A three-dimensional truss consisting of four or three chords (tri- chord), space frames are designed to resist vertical and lateral (horizontal) loads.
Spall	A fragment detached from a larger mass, by the action of weather, by pressure, impact or by expansion within the large mass.
Span Length	The total length of the structure measured from support to support. Enter N for 'Not applicable'.
Span Wire	A steel cable or strand extended between two poles.
Span Wire Structure	Structure in which the horizontal support(s) are tensioned wires attached to vertical rigid or semi- rigid supports.

Splice Joint A joint in which the elements of a member or the members of a structure are joined by a splice plate or by a part or piece functioning to secure a required amount of strength and stability.

State Plane Coordinates The State Plane Coordinate System is a coordinate system designed for mapping the United States and was developed in the 1930s by the U.S. Coast and Geodetic Survey. To maintain a high degree of accuracy, it was necessary to divide many states into zones. Each zone has its own central meridian or standard parallels. Virginia is divided into two zones. This is not the same as GPS Coordinates.

Strain The distortion of a body produced by the application of one or more external forces and measured in units of length (in./in. or ft./ft.). This is the amount of distortion divided by the original length.

Stress The resistance of a body to distortion when in a solid or plastic state. Stress is produced by the strain (distortion) and holds in equilibrium the external forces causing the distortion. It is measured in pounds/sq. in. or tons/sq. ft. Within the elastic limit the strain in a member of a structure is proportional to the stress in that member.

Structure Number This is a unique number that identifies a structure. This is a seven-digit number where the first three digits are the county/city code, with leading zero's as needed, which maintains the structure and the last four digits is the unique number of a particular structure within that maintenance jurisdiction. This number shall be assigned by the District Structure & Bridge Office and should be sequential within the maintenance jurisdiction. New structures shall receive new numbers. Where only part of a structure is replaced and some portion of the structure is reused (pole, pedestal, etc.), the number shall remain the same.

Structure Last Modified This field contains the month and year (mm/yy) when the structure was last modified, i.e., change in sign size(s), location of signs on span, etc.
Code 'N' for new structures.

Structure Type The type of structure being inspected. This is represented in the inventory by an alpha code. See the table below.

A -	Cantilever
B -	Overhead (span type)
C -	Bridge Parapet Mount
D -	High Mast Lighting
E -	Luminaires
F -	Span Wire
G -	Butterfly
H -	Camera Poles
Z -	Other (miscellaneous)

Total Sign Area The total square foot area (length x width) for all signs attached to the structure (whole numbers only). Small signs, such as, speed limit signs attached to the pole(s) should not be included in this total. However, these small signs should be noted in the report.

Tri-Chord Truss A horizontal member made of three longitudinal chords connected by bracing.

Truss A jointed structure having an open web construction arranged so that the frame is divided into a series of triangular figures with its straight members primarily stressed axially.

U-Bolt A bar bent in the shape of the letter "U" and fitted with threads and nuts at its ends.

Ultrasonic Testing A non-destructive testing technique. In sign inspections, it is used to check for cracked or sheared anchor rods.

Vierendeel Truss This truss has rigid upper and lower joints connected by vertical members and typically will not have diagonals. In this statically indeterminate truss, all members are subject to bending moments

Vertical Truss A truss in which all members lie in a vertical plane.

Verticals The perpendicular members that join the chords of a truss.

VMS Acronym for variable message sign.

VMS Type The type of VMS present shall be represented in the inventory by an alpha code. See the table below. Definitions of each may be found elsewhere in the glossary.

A -	Disc
B -	LED
C -	Fiber optic
D -	Bulb
E -	Hybrid LED
F -	Hybrid fiber optic
G -	Other
H -	Not applicable

Walkway Length The total length of the walkway attached to the structure. Enter 0 (zero) for 'Not Applicable' if no walkway exists.

Warren Truss A truss having alternating compression and tension diagonals.

Weep Hole A small opening in the bottom of a support pole for the drainage of water.

Weld Joining two or more pieces of metal through fusion of the metal.

Welded Joint A joint in which the assembled elements and members are welded.

Windbeam Horizontal member attaching sign panels to a bridge mount sign structure.

APPENDIX A

REPORTS

There are inspection reports for the following:

- Highmast Lighting and Camera Poles.
- Cantilever, Overhead, Butterfly and Other Sign Structures.
- Bridge Parapet Mounts

For the latest version of inspection reports, please contact John Coleman (804) 786-2852 of the Structure and Bridge Division.

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APPENDIX B

REPAIR RECOMMENDATIONS

TYPICAL SIGN REPAIR RECOMMENDATIONS

Note: The recommendations given on the following pages are to be used only as guidelines. The inspector must utilize judgment in the application of these recommendations, carefully analyze any deficiencies and provide recommendations for an appropriate repair.

The following Priority Codes and time frames are to be used for repair recommendations:

Priority Code	Recommended Time Frame for Repairs
L = Low Priority Repairs	Within 24 Months
M = Medium Priority Repairs	Within 6 Months
H = High Priority Repairs	Within 1 Month
E = Emergency Situation	Immediately

FOUNDATIONS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Undermining	L to E	Minor erosion – monitor. Major erosion with foundation exposure - place backfill. Any undermining - fill in undermined area (with grout) and place backfill.	(L) – Minor erosion with no undermining. (M) – Minor erosion with minor undermining (stability not affected). (H) – Major erosion with minor undermining (stability not affected). (E) – Any erosion with undermining that has affected the stability of the structure. Notify the District Structure and Bridge Engineer immediately if stability is compromised.
Cracking 1/16" or wider.	M	Seal cracks.	Determine if cracks are the result of a larger problem.
Voids, delamination or spalls with exposed reinforcing steel.	L to H	Clean and patch area.	(L) – Areas affected with no exposed reinforcing steel and no loss of bearing area of the base plate. (M) – Affected areas have exposed reinforcing steel with less than 15% loss of section and no loss of bearing area of the base plate. (H) – Reinforcing steel exposed with greater than 15% loss of section and/or there is loss of bearing area of the base plate.

GROUT PADS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Major cracking and/or delamination with numerous cracks 1/16" or wider.	M	Remove deteriorated grout pad. Unless there are no leveling nuts or the distance between the bottom of the base plate and top of pedestal is greater than the diameter of the anchor rod plus one inch.	

ANCHOR RODS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Loose nut(s).	H to E	Tighten loose nut(s).	(H) – 1 nut in a 6-rod or greater configuration. (E) – Any nuts in a 4-rod configuration. (E) – 2 nuts or more in any rod configuration. For 'E' priorities, notify the District Structure and Bridge Engineer and replace nut(s) immediately.
Sheared or cracked rod(s).	E	Remove structure.	Notify the District Structure and Bridge Engineer immediately.
Missing washer(s) or lock washers are present.	M	Install flat washer(s) and/or replace lock washers with flat washers.	
Heavy corrosion.	L to H	Clean and paint anchor rods or monitor until the structure can be replaced.	(L) – Less than 5% loss of section. (M) – From 5% to 30% loss of section. (H) – If greater than 30% loss of section of one rod in a 6-rod or more configuration. (E) – If greater than 30% loss of section in one or more rods of a 4-rod configuration or more than one rod in any other rod configuration. Notify the District Structure and Bridge Engineer and replace structure as soon as possible.
Missing nut(s).	H to E	Replace anchor rod nut(s).	(H) – 1 nut in a 6-rod or greater configuration. (E) – Any nuts in a 4-rod configuration. (E) – 2 nuts or more in any rod configuration. For 'E' priorities, notify the District Structure and Bridge Engineer and replace nut(s) immediately.

BASE PLATES			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Crack in welded connection to pole.	E	Remove structure from service, repair cracked weld.	Notify District Structure and Bridge Engineer immediately

POLES/COLUMNS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Missing Cap(s).	L	Replace cap(s).	
Loss of galvanization and/or corrosion possibly with section loss.	L to E	(L) to (H) – Clean, prepare & apply protective coating. (E) – Remove structure.	(L) – Loss of galvanization with no corrosion. (M) – Corrosion present with no measurable loss of section loss. (H) – Corrosion present with measurable loss of section that does not significantly affect the load carrying capacity. (E) – Corrosion present with measurable loss of section that has seriously affected the structural integrity. Notify the District Structure and Bridge Engineer immediately.
Cracked joint weld.	E	Repair/replace the pole.	Notify District Structure and Bridge Engineer immediately.

POLE TRUSSING			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Cracked weld(s).	L to E	Repair weld(s). Possibly replace portion or all of structure if conditions are severe or structure has reached the end of its fatigue life.	(L) – A few welds are cracked but are not in the same vicinity and cracks are less than 1" long. (M) – Several welds cracked in the same vicinity and cracks are less than 1" long (H) – Many cracked welds and cracks are greater than 1" long. (E) – Complete failure of one or more welds and/or cracks are at all members on one side of pole. Notify the District Structure and Bridge Engineer immediately.
Missing bolts in connections between secondary members and pole.	L to E	Replace missing bolts and nuts.	(L) – A few missing bolts that are not in the same vicinity. (M) – Several bolts missing. No more than 1/3 of the bolts in any one connection are missing. (H) – Many bolts missing. More than 1/3 of the bolts in a major connection are missing. (E) – Large number of missing bolts. All bolts missing from some connections on main members. Notify the District Structure and Bridge Engineer immediately.
Bent/buckled/dented member.	L to M	No action unless there is a hole in the member or the bent/buckled/dented member has caused a misalignment in a main column or chord. Otherwise repair holes and/or straighten or replace members.	(L) – No holes in members and no misalignment to a main column or chord. (M) – Hole(s) in a member allowing water to get inside or bent/buckled/dented pole trussing has caused a misalignment to a main column or chord.

('Pole Trussing continues)

POLE TRUSSING (continued)			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Missing or detached member(s).	L to E	Replace/re-attach member. In severe cases remove structure from service.	(L) – A few secondary members broken/detached but not in the same vicinity. (M) – Several secondary members broken/detached but not in the same vicinity. (H) – Several members secondary broken/detached in the same vicinity. (E) – Large number of secondary members regardless of location or one or more main members broken/detached. Notify the District Structure and Bridge Engineer immediately.
Loss of galvanization and/or corrosion possibly with loss of section.	L to M	Clean, prepare & apply protective coating.	(L) – Corrosion present could have measurable loss of section, but only to a few secondary members and the members are not in the same vicinity. (M) – Corrosion present with measurable loss of section to several secondary members and the members are in the same vicinity. NOTE: Once loss of section has caused a connection to be considered ineffective or has caused one or more members to be considered missing or detached the inspector should apply the coding of the appropriate section.

CHORDS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Loose splice flange bolts.	H to E	Tighten or replace.	(H) – One bolt loose in a non-tension chord splice. (E) – More than 1 bolt loose in a non-tension chord splice or if any bolts are loose in a tension chord splice. Notify District Structure and Bridge Engineer as soon as possible.
Missing splice flange bolts.	H to E	Replace	(H) – One bolt missing in a non-tension chord splice. (E) – More than 1 bolt missing in a non-tension chord splice or if any bolts are missing in a tension chord splice. Notify District Structure and Bridge Engineer as soon as possible.
Cracked splice flange weld to chord.	E	Remove structure from service.	Notify District Structure and Bridge Engineer immediately
Corroded splice flange bolts.	L to H	L – Clean, prepare & apply protective coating. M to H – Replace bolts.	(L) – Less than 5% loss of section. (M) – From 5% to 25% loss of section. (H) – If greater than 25% loss of section.

ALIGNMENT			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Overhead Space frame sagging	E	Remove frame from service. DO NOT CLIMB ON SIGN. Examine from bucket truck.	Notify District Structure and Bridge Engineer immediately.

SPACE FRAME TRUSSING			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Cracked weld(s) to chords.	L to E	Repair weld(s).	(L) – A few welds are cracked but are not in the same vicinity and cracks are less than 1" long. (M) – Several welds cracked in the same vicinity, cracks are less than 1" long (H) – Excessive number of welds cracked. Cracks are greater than 1" long. Single cracks greater than 2" long. (E) – Complete failure of one or more welds or an excessive amount of cracks greater than 2" long. Notify District Structure and Bridge Engineer as soon as possible.
Missing bolts/nuts in connections between secondary members & chords.	L to E	Replace missing bolts & nuts.	(L) – A few missing bolts/nuts that are not in the same vicinity. (M) – Several bolts/nuts missing that are not in the same vicinity. (H) – Many bolts/nuts missing in the same vicinity. (E) – Excessive number of bolts/nuts missing in the same vicinity or over 50% missing in more than one location. Notify District Structure and Bridge Engineer as soon as possible.
Bent/buckled/dented member.	L to M	No action unless there is a hole in the member or the bent/buckled/dented member has caused a misalignment in a chord. Otherwise repair holes and/or straighten or replace members.	(L) – No holes in members and no misalignment to trussing. (M) – Hole(s) in a member allowing water to get inside or bent/buckled/dented trussing has caused a misalignment to a chord.

('Space Frame Trussing continues)

SPACE FRAME TRUSSING (continued)			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Missing or detached member(s).	L to E	Replace/re-attach member. In severe case remove structure from service.	(L) – A few members not in the same vicinity. (M) – Several members broken or detached not in same area. (H) – Several members broken/detached in the same vicinity. (E) – Large number of members missing regardless of location or one or more main members missing or detached. Notify District Structure and Bridge Engineer as soon as possible.
Loss of galvanization and/or corrosion possibly with loss of section.	L to M	Clean, prepare & apply protective coating.	(L) – Corrosion present could have measurable loss of section, but only to a few secondary members and the members are not in the same vicinity. (M) – Corrosion present with measurable loss of section to several secondary members and the members are in the same vicinity. NOTE: Once loss of section has caused a connection to be considered ineffective or has caused one or more members to be considered missing or detached the inspector should apply the coding of the appropriate section.

POLE TO CHORD CONNECTIONS OVERHEAD SPANS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Broken weld(s) between support beam and pole(s).	M to E	Repair cracked weld.	(M) – Minor cracks with a few less than 1" long. (E) – Complete separation between support beam and column. Notify District Structure and Bridge Engineer immediately.
Loose bolted connection(s).	M to E	Tighten connections.	(M) – One or two loose nuts. (H) – Several loose nuts. (E) – Chords not attached to pole and support beam. Notify District Structure and Bridge Engineer immediately.
Missing bolts/nuts.	M to E	Replace missing nuts/bolts	(M) – One or two missing nuts. (H) – Several missing nuts. (E) – Chords are not attached to pole and support beam. Notify District Structure and Bridge Engineer immediately
Corroded bolts.	L to H	L – Clean, prepare & apply protective coating. M to H – Replace bolts.	(L) – Bolts have less than 5% loss of section. (M) – Bolts have from 5% to 25% loss of section. (H) – Bolts have greater than 25% loss of section.

POLE TO CHORD CONNECTIONS CANTILEVER SPANS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Cracked welds.	E	Remove the sign from service, repair welds or replace sign.	Notify District Structure and Bridge Engineer immediately.
Loose bolted connection(s).	H to E	Tighten connections.	(H) – Up to 30% of the bolts are loose and not in the same location. (E) – Over 30% of the total number of bolts in the same location are loose. Notify District Structure and Bridge Engineer immediately.
Corroded bolts/nuts.	M to E	Replace nuts/bolts	(M) – Bolts/nuts have less than 5% loss of section. (H) – Bolts/nuts have from 5% to 30% loss of section and not in the same connection. (E) – Multiple bolts in the same connection have greater than 30% loss of section. Notify District Structure and Bridge Engineer immediately.

SIGN TO CHORD CONNECTION			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Loose U-bolts	M to H	Tighten nuts	(M) – A few bolts loose. (H) – Numerous bolts loose.
Missing U-bolts	H	Install U-bolts	
Corroded connections	L to H	H – Install new U-bolts	(L) – Corrosion with no measurable loss of section. (M) – Corrosion with up to 5% loss of section. (H) – Greater than 5% loss of section.

SIGN CONNECTIONS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Missing bolts/nuts/studs that attach the sign clips to the windbeam.	M to E	Replace	(M) - If less than 50% of the bolts/nuts/studs that attach the sign clips to the windbeams are missing and there are no adjacent studs missing either horizontally or vertically. (H) – If less than 50% of the bolts/nuts/studs that attach the sign clips to the windbeam are missing and more than one adjacent bolt/nut/stud is missing either horizontally or vertically. (E) – If 50% or more of the bolts/nuts/studs that attach the sign clips to the windbeam are missing and more than one adjacent bolt/nut/stud is missing either horizontally or vertically. Notify District Structure and Bridge Engineer immediately
Corroded bolts/nuts/studs that attach the sign clips to the windbeam.	M to E	Replace nuts/bolts	(M) – Bolts/nuts/studs have less than 5% loss of section. (H) – Bolts/nuts/studs have from 5% to 30% loss of section with more than one adjacent bolt/nut/stud either horizontally or vertically in the same sign panel corroding. (E) – Multiple bolts/nuts/studs in the same sign panel have greater than 30% loss of section. Notify District Structure and Bridge Engineer immediately.

('Sign Connections' continue)

SIGN CONNECTIONS (continued)			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Missing bolts attaching windbeam to hanger.	M to E	Replace	(M) - If less than 50% of the bolts and/or nuts that attach the windbeam to the hanger are missing and there are no adjacent bolts and/or nuts missing either horizontally or vertically. (H) – If less than 50% of the bolts and/or nuts that attach the windbeam to the hanger are missing and more than one adjacent bolts and/or nuts is missing either horizontally or vertically. (E) – If 50% or more of the bolts and/or nuts that attach the windbeam to the hanger are missing and more than one adjacent bolts and/or nuts is missing either horizontally or vertically. Notify District Structure and Bridge Engineer immediately
Corroded bolts attaching windbeam to hanger.	M to E	Replace nuts/bolts	(M) – Bolts and/or nuts that attach the windbeam to the hanger have less than 5% loss of section. (H) – Bolts and/or nuts that attach the windbeam to the hanger have from 5% to 30% loss of section with more than one adjacent bolt and/or nut either horizontally or vertically in the same sign panel corroding. (E) – Multiple bolts/nuts/stud bolts and/or nuts that attach the windbeam to the hanger in the same sign panel have greater than 30% loss of section. Notify District Structure and Bridge Engineer immediately.

WALKWAYS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Missing locking pins for safety rail.	M	Replace missing pins.	Notify District Structure and Bridge Engineer immediately of unsafe conditions. Tag the walkway with red tags at each end.
Missing grating for walkway	M	Replace missing grating.	Notify District Structure and Bridge Engineer immediately of unsafe conditions. Tag the walkway with red tags at each end.
Broken/missing handrail sections	M	Replace sections.	Notify District Structure and Bridge Engineer immediately of unsafe conditions. Tag the walkway with red tags at each end.
Bent, misaligned members, grating	L	Repair and or realign.	

FRAME TO BEAM CONNECTIONS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Loose nut(s)	H to E	Tighten nut	(H) – A few nuts loose. (E) – Numerous nuts loose.
Missing bolt(s)	H to E	Replace bolts	(H) – A few bolts missing. (E) – Numerous bolts missing. Notify District Structure and Bridge Engineer immediately

FRAME TO PARAPET CONNECTIONS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Deteriorated concrete around bolt	E	Grout bolt(s) or remove sign.	Notify District Structure and Bridge Engineer immediately
Loose bolts to parapet.	E	Grout bolt(s) or remove sign.	Notify District Structure and Bridge Engineer immediately
Corrosion on bolts.	L to H	Remove and replace bolts.	(L) – Corrosion with no measurable loss of section. (M) – Corrosion with up to 5% loss of section. (H) – Greater than 5% loss of section.

BRIDGE BEAMS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Cracks radiating from hole for connection with sign	E	Repair or Replace	Notify District Structure and Bridge Engineer immediately

FRAME WELDS			
DEFICIENCY	**PRIORITY (L, M, H, E)**	**REPAIR RECOMMENDATIONS**	**COMMENTS**
Cracks	H to E	Repair cracked welds OR Remove sign	(H) – If in a non-critical connection. (E) – If in critical connection.

APPENDIX C

SIGN NOMENCLATURE

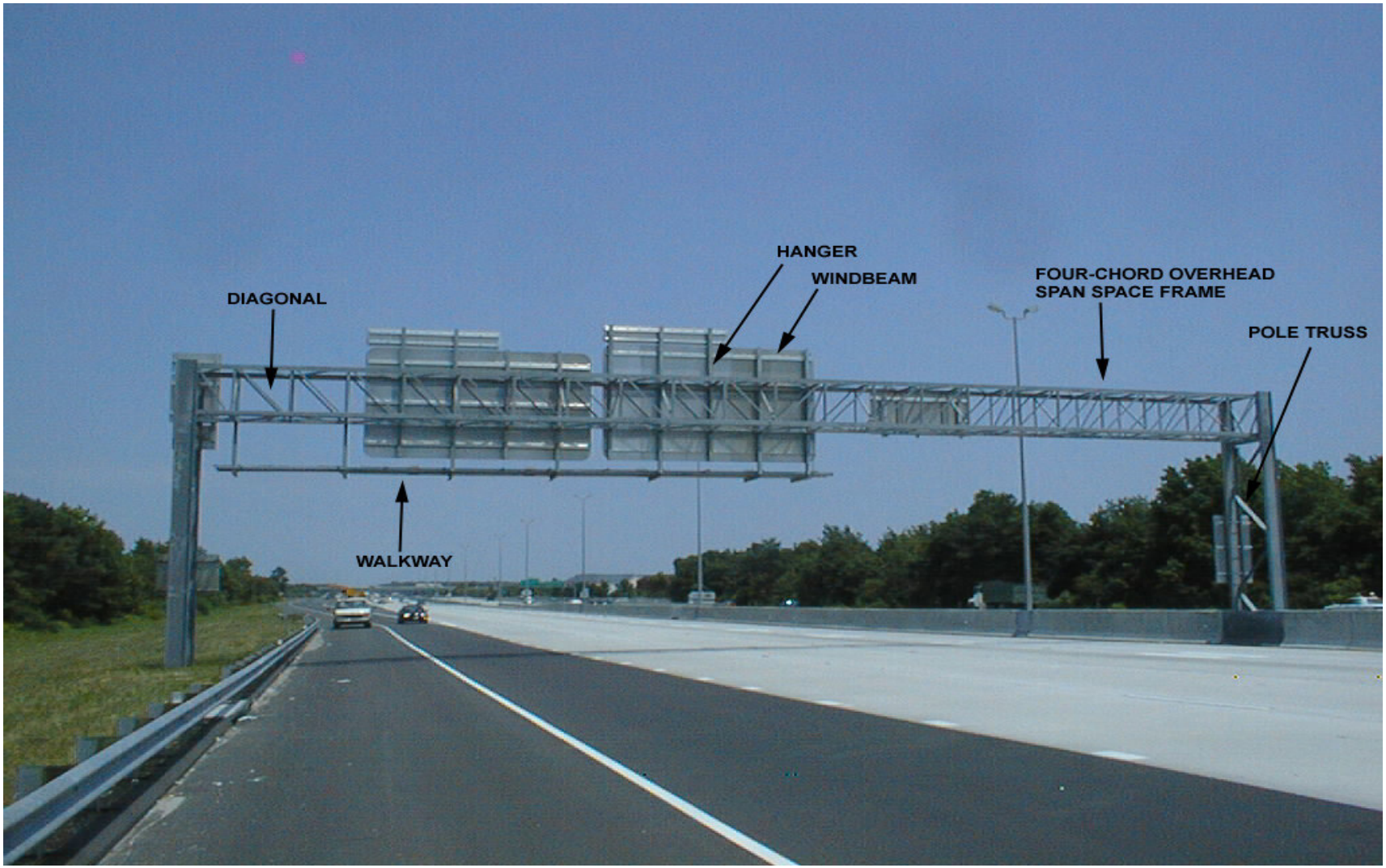

Photo 37 - Overhead Span Sign Structure

Photo 38 - Cantilever Sign Structure

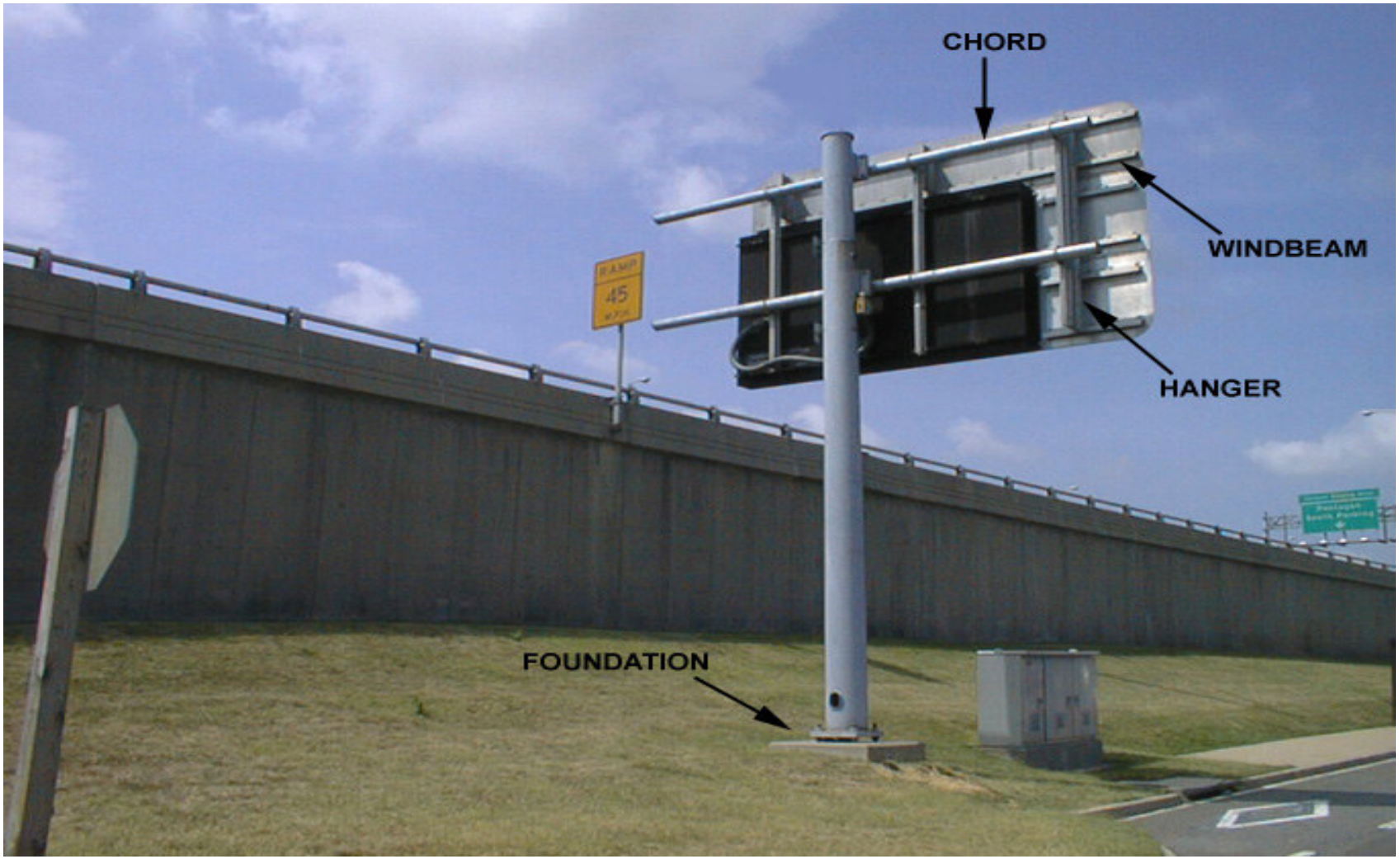

Photo 39 - Butterfly Sign Structure

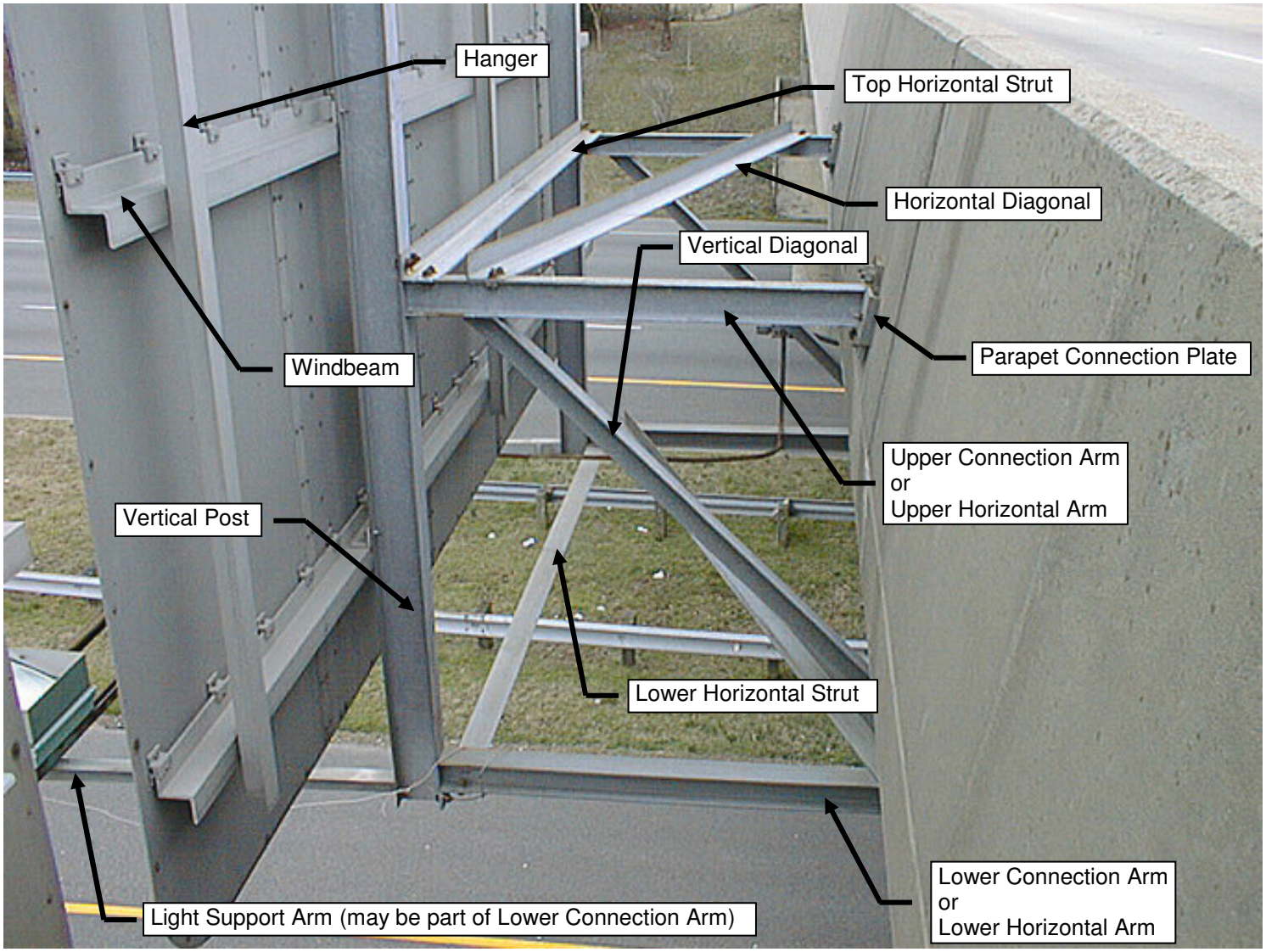

Photo 40 - Bridge Mount Sign Structure

Photo 41 - High Mast Lighting Tower

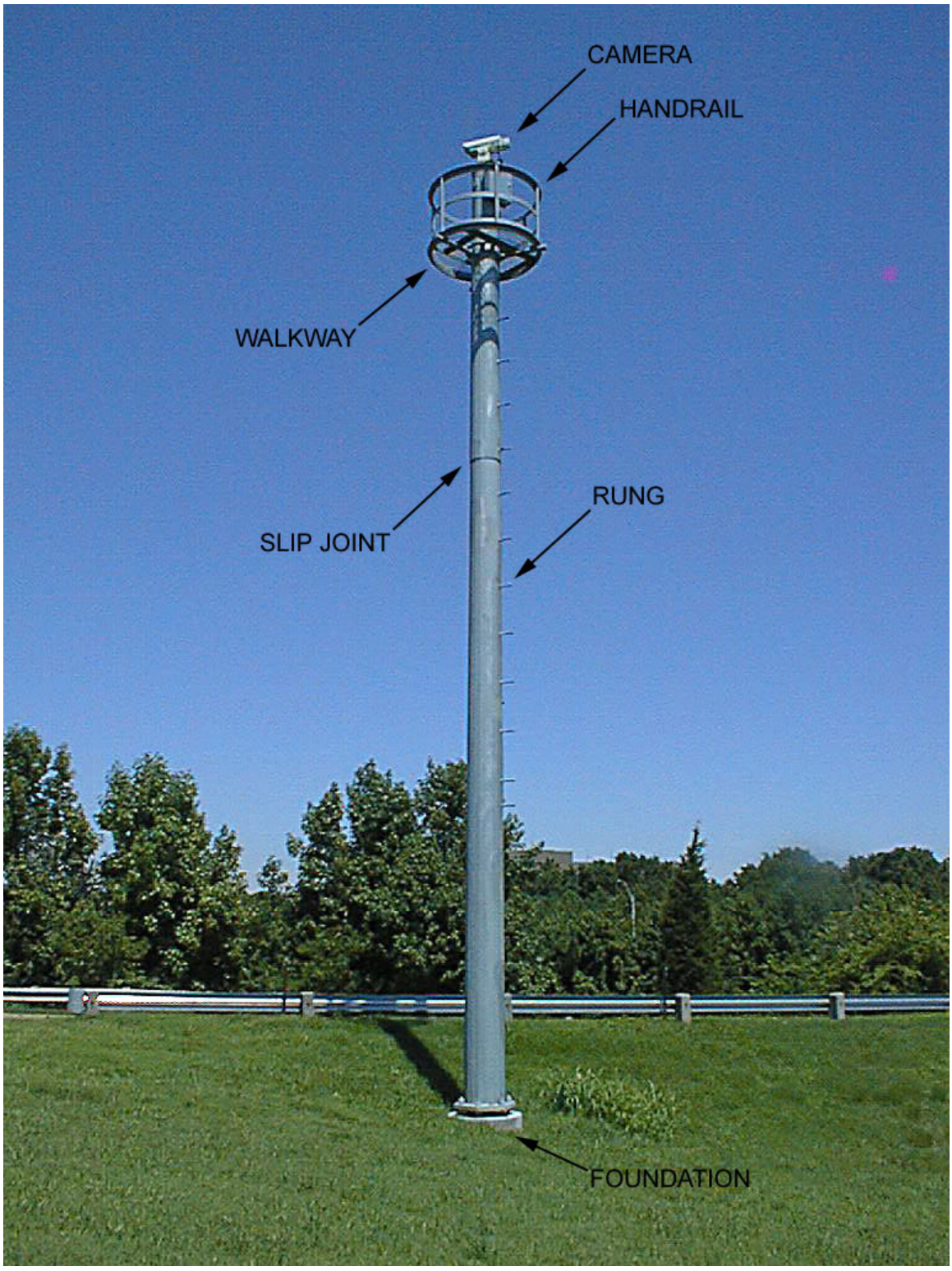

Photo 42 - Camera Pole

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APPENDIX D

EMERGENCY CONTACT LIST

EMERGENCY CONTACT LIST

MEDICAL EMERGENCY TELEPHONE NUMBERS

EMS: _____ Other: _____

Local Hospital: _____

DISTRICT

Name	Title	Telephone Number
	BRISTOL DISTRICT MAIN CONTACT	
	Bristol Dist. Structure & Bridge Engineer	
	Bristol District Traffic Engineer	
	SALEM DISTRICT MAIN CONTACT	
	Salem Dist. Structure & Bridge Engineer	
	Salem District Traffic Engineer	
	LYNCHBURG DISTRICT MAIN CONTACT	
	Lynchburg Dist. Structure & Bridge Engineer	
	Lynchburg District Traffic Engineer	
	RICHMOND DISTRICT MAIN CONTACT	
	Richmond District Structure & Bridge Engineer	
	Richmond District Traffic Engineer	
	HAMPTON ROADS DISTRICT MAIN CONTACT	
	Hampton Roads District Structure & Bridge Engineer	
	Hampton Roads District Traffic Engineer	
	FREDERICKSBURG DISTRICT MAIN CONTACT	
	Fredericksburg District Structure & Bridge Engineer	
	Fredericksburg District Traffic Engineer	
	CULPEPER DISTRICT MAIN CONTACT	
	Culpeper Dist. Structure & Bridge Engineer	
	Culpeper District Traffic Engineer	
	STAUNTON DISTRICT MAIN CONTACT	
	Staunton Dist. Structure & Bridge Engineer	
	Staunton District Traffic Engineer	
	NOVA DISTRICT MAIN CONTACT	
	NOVA Dist. Structure & Bridge Engineer	
	NOVA District Traffic Engineer	

CENTRAL OFFICE

Name	Title	Telephone Number
	Asst. State Structure & Bridge Engineer (Maint.)	
	Engineer in charge of Safety Inspection	

APPENDIX E

CRITICAL RECOMMENDATIONS FOR REPAIR OF TRAFFIC CONTROL DEVICES

VIRGINIA DEPARTMENT OF TRANSPORTATION
VDOT
STRUCTURE AND BRIDGE DIVISION

SUBJECT:
Critical Recommendations
for Repair of Traffic Control Devices

Location: _____ Mi. To: _____
_____ Mi. From: _____
Rte.: _____ Over: _____
County: _____ _____
Str. No.: Insp. Date:
Inspected By: _____

TO: _____ FROM: _____ DATE: _____
Resident Engineer — District Str. & Bridge Engineer
CC: District Maintenance Engineer
CC: District Traffic Engineer
CC: Bridge Safety Inspector

TO: _____ FROM: _____ DATE: _____
District Str. & Bridge Engineer — District Maintenance Eng.

TO: _____ FROM: _____ DATE: _____
State Str. & Bridge Engineer — District Str. & Bridge Engineer

CRITICAL CONDITION REQUIRING IMMEDIATE ATTENTION

- ☐ Immediate performance of work on fracture critical member(s) is needed.
- ☐ Immediate performance of work on superstructure and/or foundation.
- ☐ Recommendations for immediate work to prevent/protect the safety of the traveling public.

Inspection by the District Structure and Bridge Section revealed _____

Proposed Recommendation _____

Estimated Cost - $ _____

TO BE FILLED OUT BY DISTRICT MAINTENANCE ENGINEER

Action (taken) (to be taken) by (Residency) (District Bridge Section) (District Traffic Engineering Section)

Date action (was) (will be) taken: _____

Signature: _____
(Title) Date

Follow-up Inspection after work is complete

_____
Bridge Safety Inspector Date

APPENDIX F

SIGN NUMBERING CONVENTIONS AND LOCATION OF COORDINATES (GPS/SURVEY)

PAINTING/STENCILING STRUCTURE NUMBER

NUMBERING CONVENTION

A seven-digit structure number shall be used for the identification of all structures. See Glossary for details of this number.

PAINTING/STENCILING NUMBER

1. Height of lettering: The stenciled numbers shall be 2 inches in height and 1 inch between letters.

2. Location of seven-digit structure number: (Also see sketches that follow.)
    a. Bridge parapet mount sign structures: Number shall be placed horizontally, 2 inches (+/-) below the top of parapet on the face of parapet. The number shall be placed on the top rail when no parapet is present. The identification number shall be centered along the sign panel(s). The number shall not be placed on the sign. Structure numbers are required for each individual structure. Some connections to bridges have a single structural system that supports multiple signs. For this situation, a single structure number is required. For multiple signs where each sign is supported by its own structure, a structure number is required for each sign mount.
    b. All other structures: The number shall be placed at an elevation that makes the bottom number a minimum of 6 inches above the top of the adjacent guardrail/barrier. When no guardrail/barrier is present, the number shall be placed 36 inches (+/-) above the top of the anchorage. Lettering shall be placed vertically on the pole so as to be visible from oncoming traffic. For high mast lighting structures that are not located along a highway (parking lots, weigh stations, etc.), locate the structure number where it is easily visible.

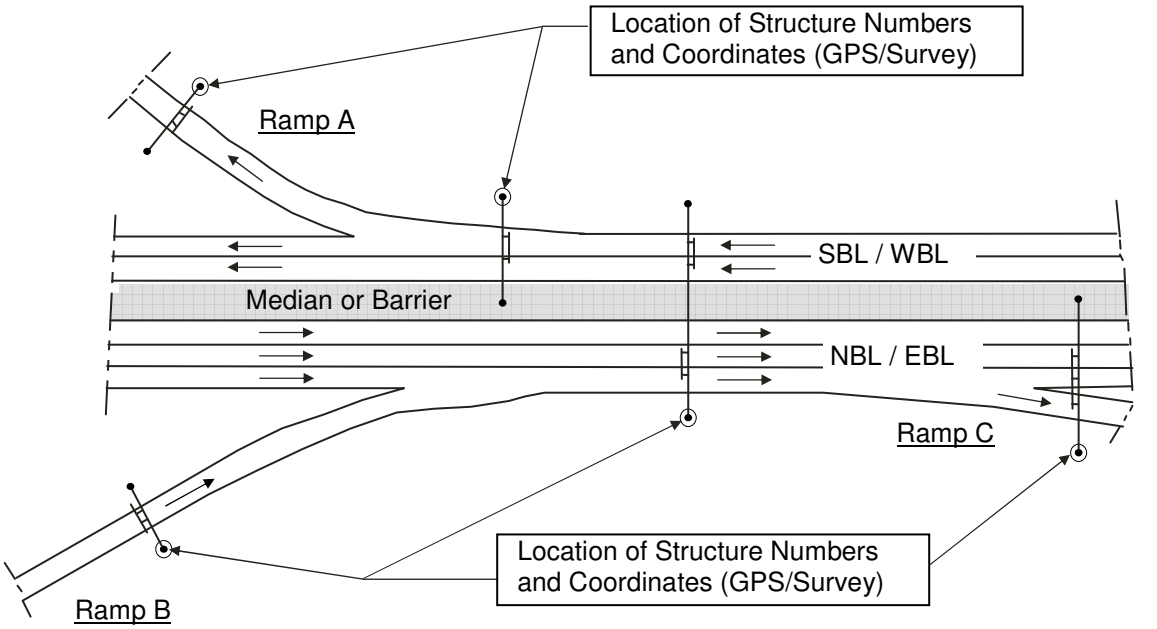
3. Existing six-digit numbers presently located on a structure do not need to be replaced with a seven-digit number until such time that the six-digit number needs replacing due to age, wear, etc.

PAINT

Any highly durable paint shall be used to stencil the number. The color of the paint shall be chosen to be in high contrast to the color on which it is being applied.

As an alternative to painting the number, reflectorized panels or numbers may be applied to the structure. Reflectorized panels shall be placed in the same location that numbers would have been otherwise painted. The numbers on the reflectorized panel shall be of the same height and spacing as described for stenciling.

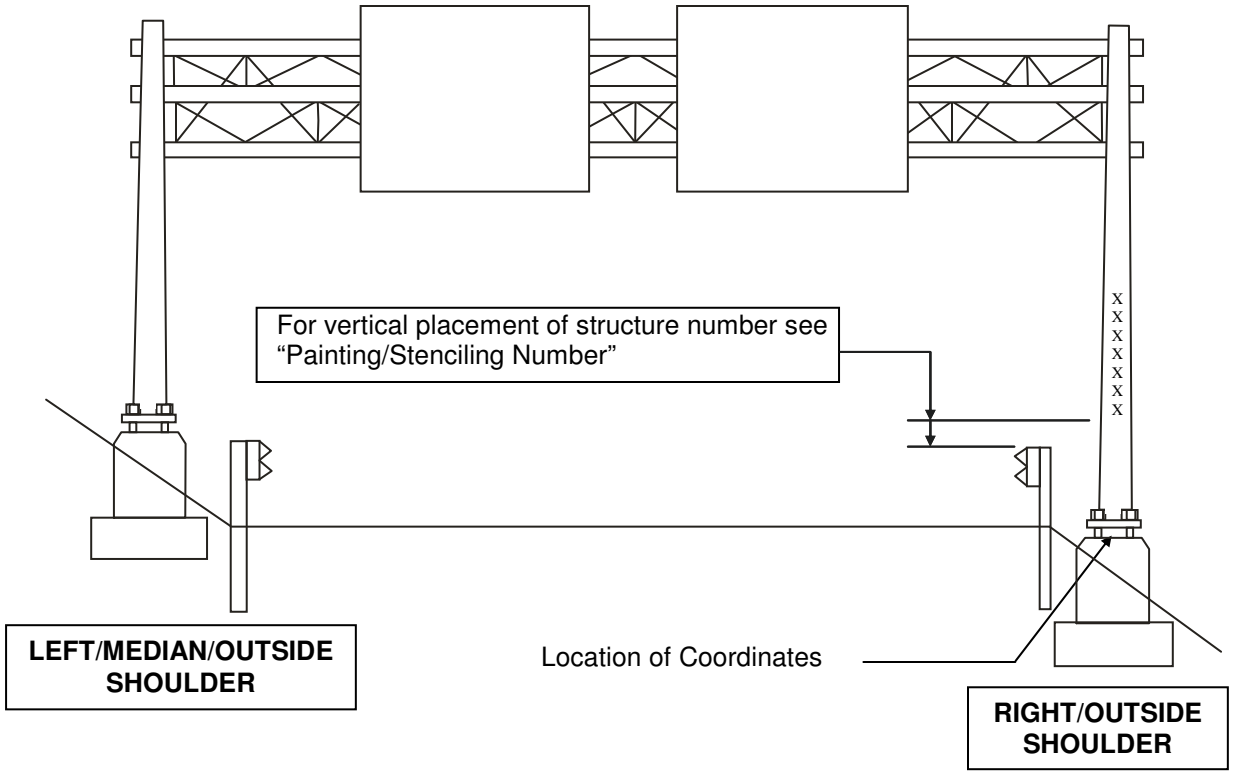
OVERHEAD SPAN SIGN STRUCTURES
(ONE WAY TRAFFIC AND TRAFFIC IN TWO DIRECTIONS)



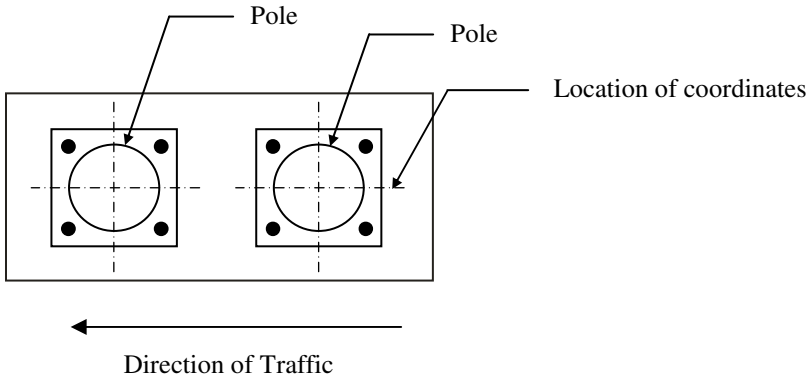
For structures that cross lanes carrying traffic in only one direction coordinates shall be obtained at the rightmost pole in the direction of travel.

For structures that cross lanes carrying traffic in both directions coordinates shall be obtained at the rightmost pole looking in the main direction of travel (northbound or eastbound)

OVERHEAD SPAN SIGN STRUCTURES
(ONE WAY TRAFFIC AND TRAFFIC IN TWO DIRECTIONS)

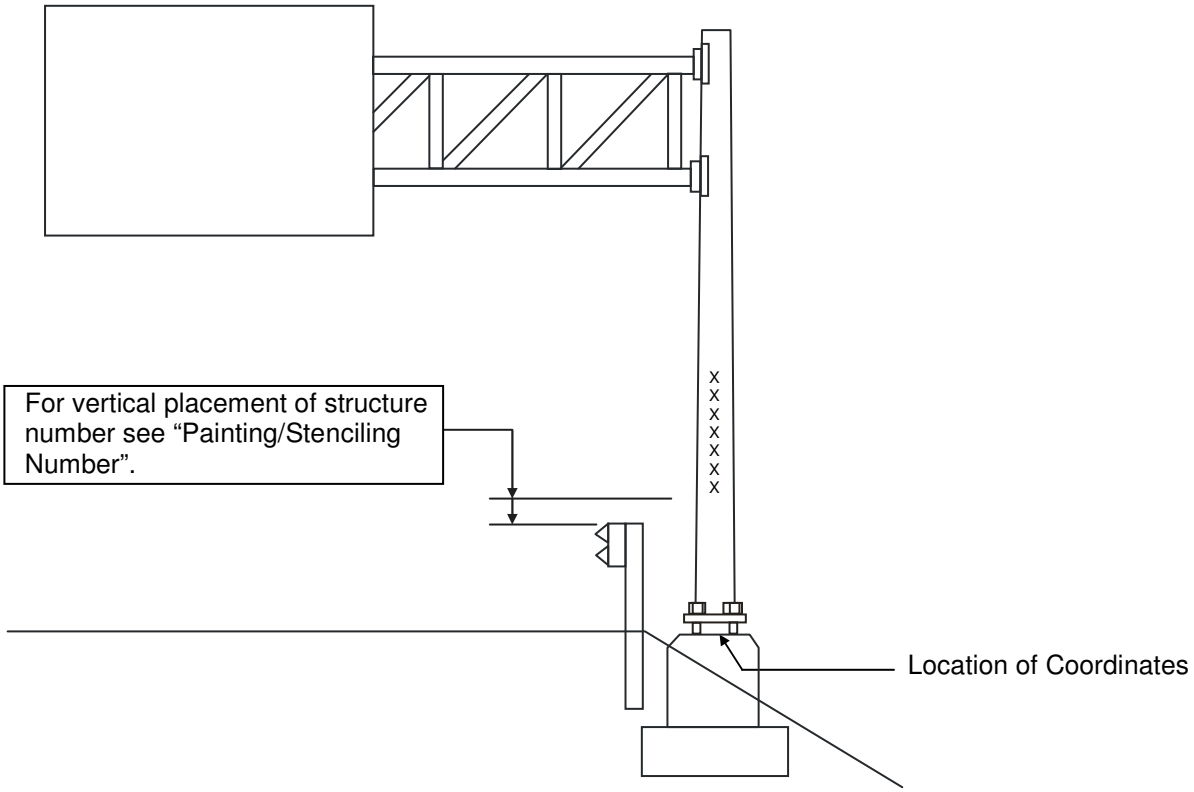


LOOKING IN THE DIRECTION OF TRAVEL



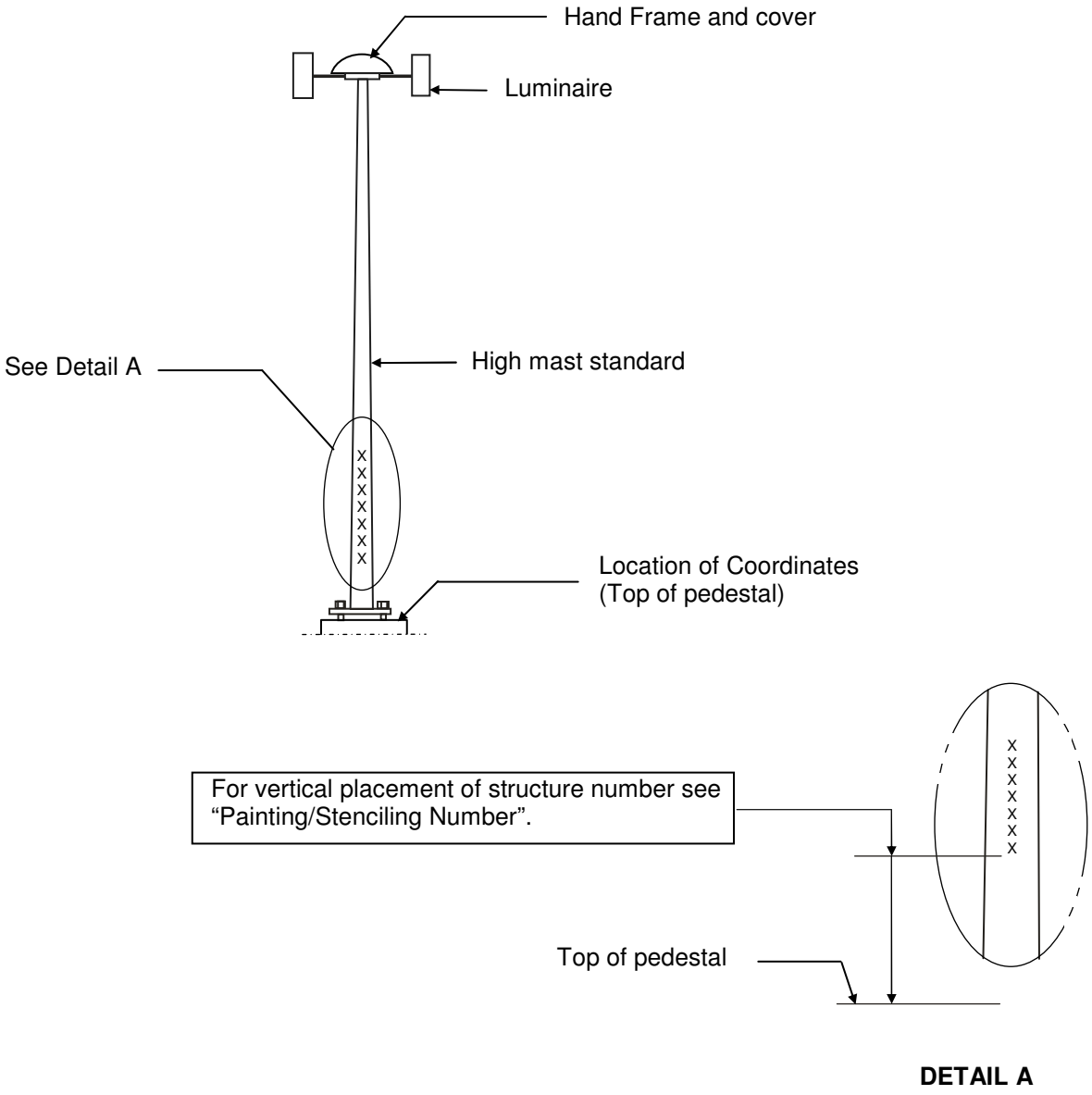
PLAN VIEW OF FOOTING

CANTILEVER SIGN STRUCTURES



LOOKING IN THE DIRECTION OF TRAVEL

HIGH MAST LIGHTING STRUCTURES

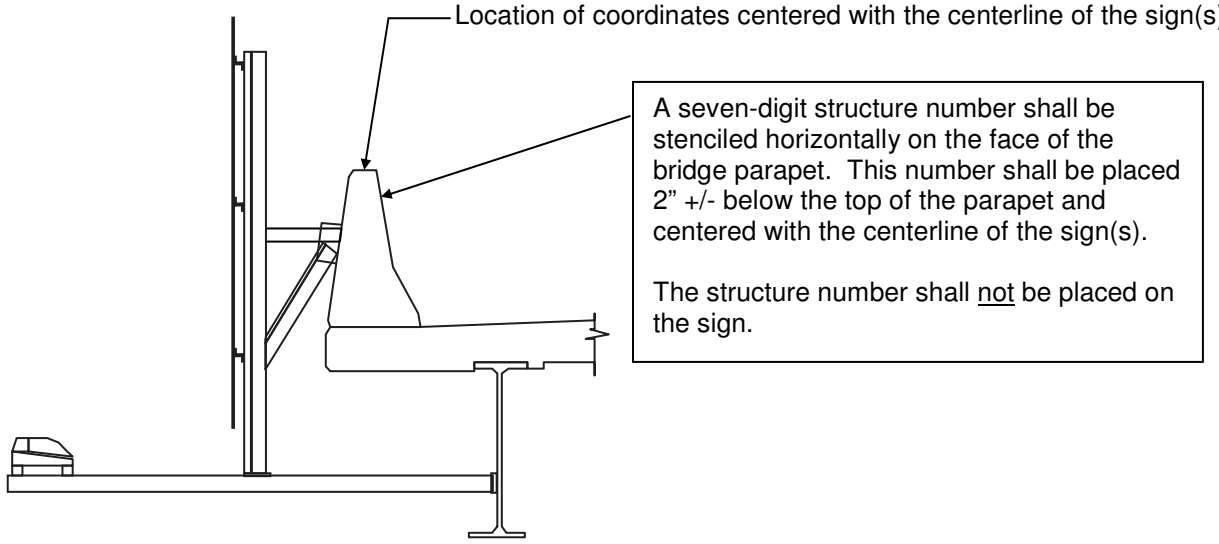


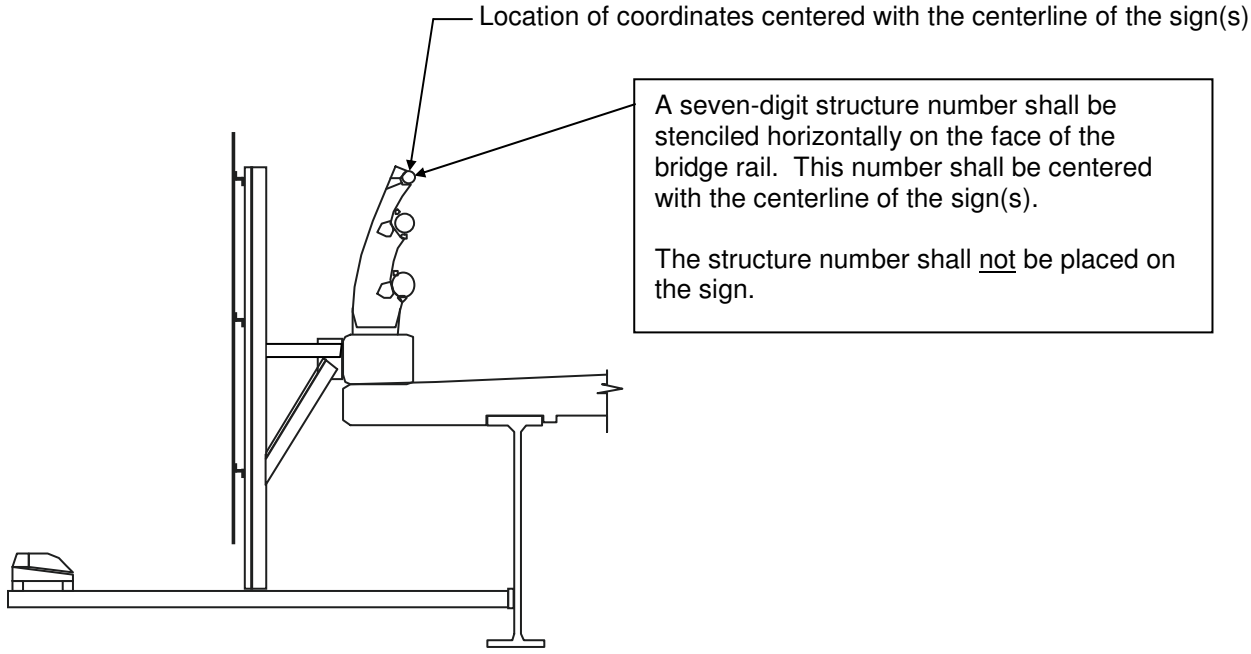
DETAIL A

BRIDGE PARAPET/RAIL SIGN MOUNT

(Attachment to bridge parapet or bridge rail)

Note: A structure number and a set of coordinates are required for each individual structure. Some connections to bridges have a single structural system that supports multiple signs. For this situation, a single structure number and a single set of coordinates are required. For multiple signs where each sign is supported by its own structure, a structure number and a set of coordinates are required for each sign mount.





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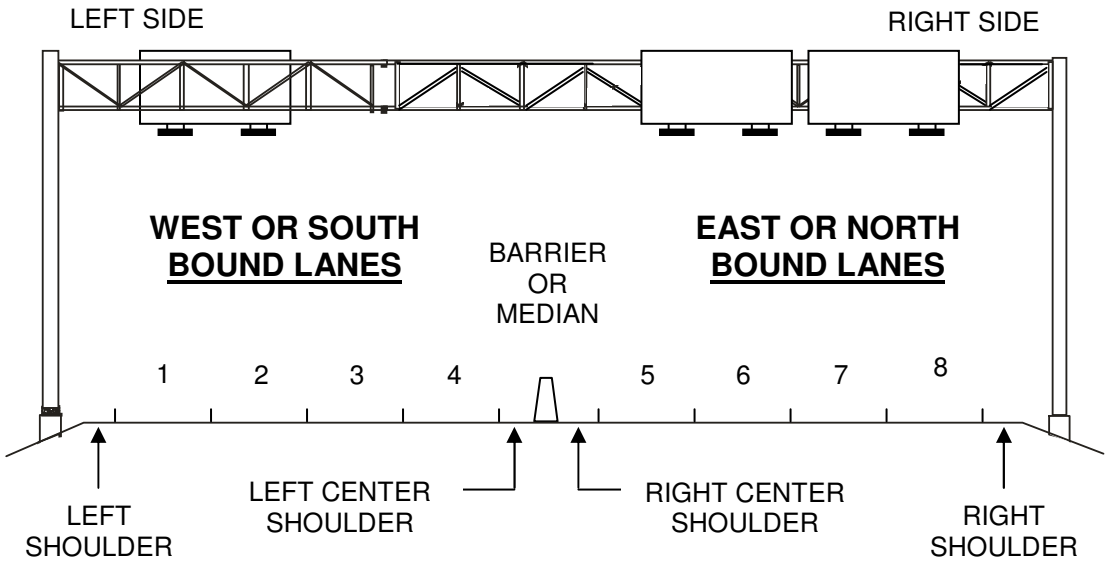
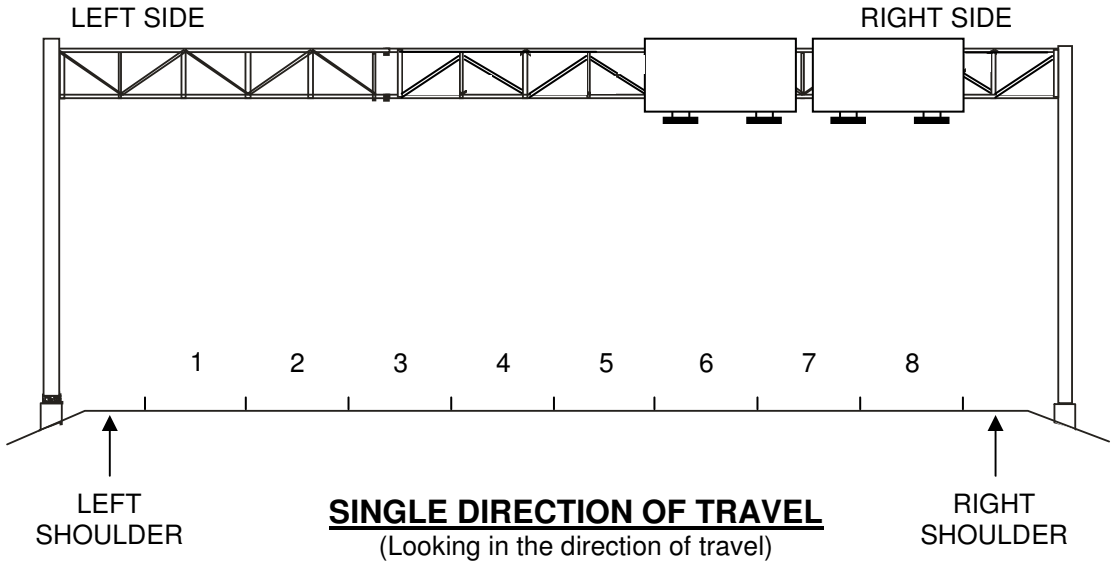
APPENDIX G

LANE NUMBERING CONVENTION



DUAL DIRECTIONS OF TRAVEL

(Looking in the direction of travel for east or north bound lanes)



SINGLE DIRECTION OF TRAVEL

(Looking in the direction of travel)

NOTES

Routes are typically stationed from south-to-north or from west-to-east. Keeping with this method, the left and right sides of a structure shall be determined as if the inspector is standing and looking at the structure in the direction of ascending mileposts i.e. looking south-to-north or west-to-east. There may be situations where the roadway orientation changes, the roadway orientation is unknown or there is no milepost system for the classification of the route. In those cases, the inspector will assume a directional orientation, note the assumption on the inspection form and attach a sketch to the report showing the lane numbering system.

Where all lanes are traveling in the same direction the inspector shall look in the direction of travel to determine left and right.